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Controllable Determinants of Residential Housing Starts

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CONTROLLABLE DETERMINANTS OF

RESIDENTIAL HOUSING STARTS

(TITLE)

BY

JEFFREY W. WIESE

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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CHAPTER 1

INTRODUCTION

Adequate housing is of national concern and importance. "There is wide agreement in the United States that housing is not just another economic good, but a social necessity requiring public regulation and affirmative assistance."[1]

The Federal Government must believe this since it has instituted many policies aimed at the improvement of the national housing situation.

The first major action was the implementing of the Federal Housing Administration in the 30's. Since then a number of government agencies have been set up to improve the housing situation, among which are the Veterans Administration, Federal National Mortgage Association, Federal Home Loan Bank, and the Farmers Home Administration.

More recently, the national attention has been turned specifically to the plight of the cities. Among the first thoughts that enter one's mind when the inner city is mentioned is that of a slum, that is, inadequate housing. Essentially, a slum consists of run-down buildings, with a large number of people living in a relatively small

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[1]Martin Meyerson, Barbara Terrett, and William Wheaton, Housing People and Cities (New York: McGraw Hill, 1962), p. 243.

area. The cabinet department of Housing and Urban Development was instituted to help deal with this situation.

In spite of the importance of housing, surprisingly little study has been made on the subject. "Minor food items have been studied far more extensively than major durable items."[1] The purchase of housing is more involved than that of most major durables, a condition which is primarily due to the high cost relative to income. Financing is normally a must for its purchase.

The various studies that have been made indicate that a large quantity of factors influence the amount of housing starts (the number of housing units started each year, including multiple family units).

A number of these determinants are under government control. Due to the acceptance of the need for government intervention in the housing market, I devoted my study to these factors. This enables an analysis of the effectiveness of these controllable variables. It will consequently provide a basis for their use or rejection in effecting changes in the housing market, as well as analyzing the effect on housing when these variables are changed for other reasons.

Aims

Government's influence on the housing market may be categorized as direct or indirect. The direct influence is through public

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[1] Arnold C. Harberger, The Demand for Durable Goods (Chicago: University of Chicago Press, 1960), p. 3.

housing projects which account for a mere 1 per cent of total housing units.[1] The indirect effect has been felt through organizations like the FHA, and non-institutional factors like the money supply, deficit, and interest rate.

A statistical analysis of the government's indirect influence will be helpful in evaluating the extent government can affect the housing supply. The direct influence (public housing) is ignored because of its small role in the past, though it could be a very important factor in the future.

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[1]Wallace F. Smith, Housing: The Social and Economic Elements (Berkley: University of California Press, 1970), p. 477.

CHAPTER 2

THE PROBLEM

The housing market has peculiar problems shared by few other commodities. As previously mentioned, housing is an expensive item and requires mortgaging in most cases. Even the apartment building does not escape, for though the tenants do not have the problem of mortgaging, the owner does.

Housing stock or supply is another major problem. For all practical purposes, the existing housing stock is immobile. One area can have a surplus of housing units, while another has a shortage and neither can help each other. There is little doubt that new housing units will be built where there is a shortage. Building will be limited in the surplus area, that is, the area where there is a high vacancy rate for existing housing units. However, while there is no problem for the city with the surplus the shortage of vacant units in the other area is a major problem.[1] First, and most obviously, is that it takes time for the construction of a housing unit. Considering all the aspects of housing construction, a housing shortage may not be affected by new construction for almost a year. The

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[1] Contractors and builders will hold an opposite view however. They will benefit in a shortage due to the bidding up of prices and will suffer in a surplus when vacant units cannot be filled.

period is likely to be much longer since all the demanded housing units probably will not be started immediately. According to a model developed by Muth, where housing demand is based on a long run equilibrium of rents and rate of return on housing investments, it takes 6 years to get a 90 per cent adjustment in the housing market to change in demand.[1] This interim period will be characterized by high rents and purchase prices due to the competition for the available units.

The situation could be worsened by the possible cyclical nature of housing. If housing is cyclical, as some studies suggest, and a shortage occurs in the contracting stage of construction, the shortage period could last longer.[2] The cost of rents and purchase prices would then continue to rise for a much longer period of time. This is the type of situation that would benefit greatly by selective government actions to reduce shortages and counteract the possible effects of the construction cycle.

Intervention would be beneficial since a prolonged housing shortage would have adverse effects on consumers, especially certain groups like the poor and those on fixed income. These two groups

[1]Richard F. Muth, "The Demand For Non-Farm Housing," in Urban Analysis: Readings in Housing and Urban Development, eds. Alfred N. Page and Warren R. Seyfried (Glenview, Illinois: Scott Foresman and Company, 1970), p. 164.

[2]A discussion of the cyclical nature of housing will follow in the next chapter.

are hurt in two ways during a housing shortage. First, by the rising

housing costs, and secondly by the reduction of the filtering process.

Filtering is one of the major ways the poor acquire housing;

it is the process by which housing that has served one group of

population is handed down to a lower income group.

> But if the process (filtering) is to work
> in the housing market as it does in the auto-
> mobile market, there must be a substantial
> enough increase in the production of new
> housing to force freer circulation of essen-
> tially sound, old housing, and there must
> be a steady removal of substandard and
> blighted housing at a faster rate and in
> larger numbers than present removal plans
> contemplate. [1]

Hence, in any kind of housing shortage, the filtering is reduced, and

the poorer groups are not able to "move-up."

"The National Commission on urban problems and the President's

commission on urban housing generally agreed that six million or more

housing units should be replaced because they are regarded as sub-

standard." [2] Filtering would be a good remedy of this situation, but

to be successful it is necessary to have substantial amounts of new

housing in the area for the original owners to "move-up" into.

A direct expenditure of government funds on building would have

an almost immediate effect on the supply of housing. This direct

expenditure, of course, is done in public housing programs. How-

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[1]Meyerson, Housing People and Cities, p. 43.

[2]Smith, Housing: Social and Economic Elements, p. 463.

ever, as previously mentioned the amount of public housing units relative to private housing is very small, and it does not appear that a change in this situation is coming in the near future. It must also be remembered that currently public housing projects are for the poor and have negligible effect on the housing shortages that effect the moderate income groups. The moderate income groups are generally not eligible for public housing, consequently accelerating a public housing program would not alleviate the problem of a housing shortage for this group.

The Federal Government has attempted to help these moderate income groups through organizations like the FHA and VA.

"The Federal Housing Administration (FHA) was established by the National Housing Act of 1934."[1] It does not make loans, nor is it engaged in the construction business.[2] The FHA is basically an insurance agency. It insures lending institutions against losses incurred on certain types of mortgage loans.[3] Although it is not a direct lender, or engaged in construction, it does have a major impact on the housing industry through its insurance activities, since eligiblity for FHA insurance requires that certain conditions be met.[4] These

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[1]Lawrence V. Conway, Mortgage Lending (Chicago: American Savings and Loan Institute Press, 1960), p. 229.

[2]Henry E. Hoagland, and Leo D. Stone, Real Estate Finance (Homewood: Richard D. Irwin Press, 1969), p. 508.

[3]Conway, Mortgage Lending, p. 229.

[4]Ibid., p. 234. For an outline of these requirements see

requirements affect the industry because of the desirability of being qualified for FHA insurance. Essentially, the purpose of the FHA is to reduce the risk of mortgage loans to lending institutions. It is hoped that the reduction of risk will result in more liberal lending practices,

The VA (Veterans Administration) also has programs aimed at the housing market. Through the Servicemans Readjustment Act after WW II, the government set up a loan guarantee for eligible exservicemen. This guarantee was to substitute for the lack of downpayment, which ranged from 25 to 40 per cent.[1] The initial terms were restrictive and have been changed a number of times over the years.

Other government agencies provide even less of an indirect effect than the VA and FHA. The general purpose of those other agencies is to provide liquidity for the lending institutions. "The Federal National Mortgage Association (FNMA or Fanny Mae) buys and sells FHA insured and VA guaranteed mortgages..."[2] which create a secondary mortgage market. This proves liquidity for the lending institutions by creating a market for existing mortgages. If a lending institution needs money, it can sell some of its mortgages, and similarly, if it has too much cash, it can buy existing mortgages

Mortgage Lending by Lawrence V. Conway or any good text on real estate financing.

[1]Hoagland, Real Estate Finance, p. 536.

[2]Conway, Mortgage Lending, p. 722.

on the secondary market. Consequently, it is hoped that lending

institutions will not be conservative in their lending policies, since

there is less fear of being caught in a liquidity crisis. There are

other agencies with the same general purposes that over the years

have been created to cope with the housing situation, but by far,

these three are the most important. [1]

These organizations have not constituted a complete solution

to the problems of housing, although they are beneficial.

The non-institutional variables that the government controls

are the money supply, fiscal budget, and interest rate. An analysis

of the relationship that these factors have upon housing starts will

be beneficial in developing housing programs. This study will

attempt such an analysis.

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[1]A summary of all the government's housing agencies can be
found in Hoagland's, Real Estate Finance.

CHAPTER 3

THE NATURE OF HOUSING

Most of the literature on the topic of housing has been of an
a priori nature with very little empirical study. This state of affairs
is due, in part, to a lack of reliable data on the subject. Prior to
World War II there is a substantial lack of information, and only
recently have amounts of data sufficient for empirical study been
generated.

There are specific areas that will probably be beneficial to
review for the purpose of this study. The first part will discuss
the supply and demand aspect of housing, and the second will treat
the cyclical nature of housing construction.

Duesenberry suggests that housing construction is a result of
three interacting dynamic processes. These are

1. The adjustment of prices and rents to the
    demand and supply of houses.

2. The adjustment of the rate of construction
    to rents, house prices and construction costs.

3. The changes in supply resulting from con-
    struction of new houses and deterioration
    of old ones. [1]

These three factors outline the profit possibilities in the housing

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[1] James S. Duesenberry, Business Cycles and Economic Growth
(New York: McGraw Hill, 1958), p. 137.

sector, which affect construction.

Maisel develops and empirically tests a model for housing starts with factors similar to Duesenberry's. The hypothesized equation is

$$St = \triangle HH + Rem + \triangle V + \triangle I,$$

where St is housing starts, HH is household formation, Rem is removal from the market, V is vacancies, and I is inventory of units under construction. [1]

Maisel states that his results indicate that household formations and removals have little effect upon housing starts. He does find that housing starts are strongly related to vacancies and inventories. The total explanation of his relationship for quarterly data was 88 per cent and 99 per cent for annual data. These results seem reasonable since as more housing units are demanded, vacancies decrease, prices are bid up and new construction will start because of profit expectations. Prices are not explicitly included in Maisel's equation, but are included as a component of the variable vacancies.

The demand for housing is subject to a larger, if not more complicated, number of factors. At an aggregate level, Duesenberry suggests that the demand for housing is a function of the following. [2]

    1. Aggregate income.

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

[2]Duesenberry, Business Cycles, p. 138.

2. Number of families.

3. Non-housing assets.

4. Housing assets.

5. Prices of houses.

6. Level of rents.

7. Prices of other goods.

8. Credit terms.

Of course, some of these factors are more important than others and there are some that are not universally accepted. Only the more important factors and those about which there is disagreement will be discussed.

Duesenberry suggests that non-housing assets are one of the variables that deserve special comment. Non-housing assets are important in that they are instrumental in providing potential buyers with the necessary downpayment on a mortgage. The larger the downpayment, the more liberal the credit terms, reflected primarily by a lower interest rate and smaller monthly payments. "The demand for credit is a negative function of downpayment...."[1] Downpayment, then, is probably the most important element in determining credit terms, and according to a study by George Break, housing construction is sensitive to the terms on which mortgages can be obtained.[2]

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[1]Jack M. Guttentag, "The Short Cycle and Residential Construction," American Economic Review, Vol. 50 (June, 1961), p. 283.

[2]George Break, "The Sensitivity of Housing Demand to Changes

The importance of income appears to meet with less than full

agreement. Guttentag states "the demand for housing, moreover,

apparently is not very sensitive to short run changes in income."[1]

Lewis and Turner state that house building has a significant, but

not a closely calibrated, relationship to disposable personal income."[2]

There is an apparent contradiction here. It should be noted though

that the first statement refers specifically to short run changes in

income and the latter makes no such reference. The context from

which the latter was taken does seem to imply a short run situation,

but this still does not necessarily indicate disagreement. Guttentag

is referring to short run changes, whereas Lewis and Turner state

demand is a function of the level of income. Muth sums the situa-

tion up very well, "... people's housing does not change with every

short change in income. At the same time it is generally true that

individual's housing is in tune with their normal level of income."[3]

There is no general concurrence concerning the effects of

household formation on housing starts. Household formations are

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in Mortgage Credit Terms," in Urban Analysis eds. Alfred N. Page
and Warren R. Seyfried (Glenview, Illinois: Scott Foresman and Co.,
1970), p. 115. In this study, Break analyzes the effect of credit
factors including a "terms-of-credit" variable, which he derives by
using average interest rates, loan to value ratios, and maturity lengths.

[1]Guttentag, "Short Cycles," p. 283.

[2]John P. Lewis and Robert C. Turner, Business Condition
Analysis (New York: McGraw Hill, 1967), p. 476.

[3]Muth, "Non-Farm Housing," p. 158.

often found in the a priori lists of the determinants of housing construction. Duesenberry includes them as a determining factor, but in a study by Maisel they have no significant effect upon housing starts.[1] This lack of significant effect does contradict the a priori nature of the variable. This contradiction may be explained by the fact that the a priori analysis does not take into consideration the process of doubling (and undoubling). Essentially, doubling is a situation where one family moves in with another so that two (or more) families live in a single housing unit. Consequently, a marriage may not increase the demand for housing if the conditions which cause doubling are present. Conversely, if conditions which result in undoubling are present, there will be an increase in demand for housing regardless of the number of family formations. The reasons for this practice do not seem directly attributable to any single specific factor such as income (though it no doubt does effect the amount of doubling), but probably to a number of diverse factors.[2]

The most thoroughly investigated aspect of housing is its apparent cyclical nature. There is evidence of both a long and short cycle.

"The long cycles are usually explained as or due to fluctuations

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[1]Maisel, "Fluctuations in Construction," p. 374.

[2]The causes of doubling are not fully understood but probably consist of economic factors such as income, unemployment and so forth, and also non-economic factors such as a wife moving in with her parents when her husband is serving in the military.

in demand."[1]   These long swings run from 15 to 20 years which

seem to reflect long waves of population changes and have no con-

sistent relationship to income.[2]   Arthur F. Burns[3] develops a non-

pecuniary economic model in which he shows that long cycles in

construction will be produced.   These long cycles are due to the

rate of population increase, the inconsistency of housing standards,

the immobility and durability of dwellings, and the uncertainities of

planning.   Burns maintains that in a pecuniary economy, these influences

are magnified by factors such as imperfect market information.

The short cycle has come under closer scrutiny.   Housing starts

appear to show a countercyclical tendency or at least a strong lead

in relationship to general business fluctuations.

> Construction declined during the late stages
> of the expansion in general business and ended
> in late 1948 and mid 1953, and throughout most
> of the expansion running from late 1954 to late
> 1957. It rose throughout most of the two brief
> recessions in 1948-9 and 1953-4, and was a
> stabilizing influence during the 1957-8 recession.[4]

Guttentag suggests that mortgaging is very sensitive to credit terms,

and during periods of business expansion, available money is taken

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[1]Guttentag, "Short Cycles," p. 281.

[2]Leo Grebler and Sherman J. Maisel, "Determinants of Residential Construction," in the Impacts of Monetary Policy by the Commission on Money and Credit (Englewood Cliffs, N.J.: Prentice Hall, Inc., 1963), p. 490.

[3]Ibid., p. 489.

[4]Guttentag, "Short Cycles," p. 278.

up by business and industry, and housing starts decrease due to this lack of mortgage funds. During a business contraction, business and industry demand less money, and general monetary policy will probably be relaxed. The result will be an easing of mortgage credit terms which will have an expansionary effect on housing construction. In the foregoing manner, housing starts increase when other sectors continue to decline.[1] No doubt there is a lower limit to this process. If the contraction goes "too far" credit will tighten as a result of pessimism, as happened in the 30's.

Maisel, while not disagreeing with the above explanation, suggests that these short cycles are really due to fluctuations in the vacancy rate, which as previously pointed out is a major factor in housing starts. He observed that these building periods have followed low vacancy rates and vice versa.[2] An interesting question arises from these two explanations. That is, is there any relationship between business conditions and the vacancy rate. The movement of the "business cycle" as described and the fluctuation in the vacancy rate may be coincidence, or there may actually be a relationship. A relationship might exist indirectly through the process of (un)doubling, an interesting situation that could benefit by further study.

As should be evident, the nature of housing is not fully under-

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[1]Ibid., p. 291.

[2]Maisel, "Fluctuations in Construction," p. 377.

stood.   There exists too many <u>a priori</u> statements and not enough empirical study. For adequate housing policies to be developed there must be substantial knowledge on which to base these policies. The vague statement: general monetary policies have a relatively predictable effect on housing[1] prompted the following statistical study. This study should result in a more accurate, specific description of the relationship between housing starts and monetary policy (along with other government controlled variables).

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[1]Smith, <u>Housing,</u> p. 492.

CHAPTER 4

THE ANALYSIS

The hypothesized equation for this study is

$$HS=F(Mar, MS, Def, I, Sp),$$

where HS is housing starts, Mar is marriages, MS is money supply,
Def is deficit, I is interest rate, and Sp is the difference between
the interest rate and FHA rate.

The method used to test this equation is a least squares step-
wise multiple regression analysis. Although this is a very useful
method of analysis when controlled experimentation is not possible,
it can have serious drawbacks. In the interest of accuracy, its short-
comings should be discussed so a more intelligent interpretation of
the results is possible.

Data Error

Since the data used are national aggregates and have gone through
numerous stages of collection, the possibility of errors in measure-
ment is great. These can range from human errors in collection to
hidden bias and other sampling errors. It is hoped in all investigations
using economic data that these errors have been minimized to accept-
able ranges, but consideration must be given to these error possibil-
ities before accepting results.

Least Squares Assumptions[1]

For a least squares analysis to yield valid results, a number of assumptions must be met. If any of these assumptions is not met, invalid results may be obtained. The possibility of a violation of any of the assumptions must be considered before accepting the results of this study.

A violation of any of the following could cause inaccurate results. Least squares analysis assumes that:

1. Disturbances (individual error) must have a random effect, their means and variance 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 can be no autocorrelation of error (autocorrelation is common among economic data so a more detailed discussion will follow).

5. The error term must follow a normal distribution.

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

Other Sources of Error

Three more sources of error should be mentioned. The first is that a hypothesized equation assumes there is a causal relationship between the independent and dependent variables.

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[1]The following is drawn from Edward J. Kane, Economic Statistics and Econometrics, (New York: Harper and Row, 1968), pp. 355-359.

Finding a significant amount of correlation does not necessarily imply a causal relationship between the dependent and independent variables. There may be an outside variable that is the causal action and the independent variables, along with the dependent variable, are the effects.

Another error possibility arises from the use of a stepwise analysis. This removes an independent variable on each "step" and consequently eliminates it from being retested. A variable discarded because of insignificance could become significant in the absence of a successive variable, but once removed it is not retested. This could cause distorted results.

Simultaneous equation bias is the third possibility of error. Essentially, this bias is a situation where there are actually more relationships responsible for determining the dependent variable than hypothesized. Such a possibility is exemplified in the following. The coal mining industry is a customer for steel and vice versa. The amount of steel bought by the coal industry depends upon the volume of coal sold, which is heavily dependent upon the demand for coal from the steel industry.[1] An analysis of demand for coal then, that does not take this simultaneous relationship into consideration may cause erroneous results.

A chance always exists that there are more relationships present

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[1]William J. Baumol, Economic Theory and Operations Analysis 2nd ed., (Englewood Cliffs, N.J.: Prentice Hall Inc., 1965), p. 221.

than are accounted for by the hypothesized equation(s). The presence of unaccounted for relationships may also reduce the validity of a least squares analysis.

The error possibilities discussed could put us in a position of committing a type I or II error in our analysis. This is rejecting a true hypothesis or accepting a false one, respectively. Consequently, the results of this study should not be taken without reservation though all attempts have been made to minimize these error possibilities.

Autocorrelation

Autocorrelation means that the error term is not an independent random variable.[1] In the case of economic data, the error term is often serially dependent on previous error terms, or autocorrelated. Chance disturbances in time series data, such as war, which persist through several periods cause the error term not to be independent in each period. According to the assumptions of the least squares method, this term must not be autocorrelated or the results of the analysis will have less validity. Therefore, a test to determine if autocorrelation exists is necessary. The Durbin-Watson statistic is such a test.

The statistic is calculated from the residuals (actual value of the dependent variable less the predicted value), using this formula:

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

$$d = \frac{\sum_{t=2}^{N}\left(R_t - R_{t-1}\right)^2}{\sum_{t=1}^{N}\left(R_t\right)^2}$$

Where d equals the Durbin-Watson statistic, t indicates the number
of the observation, and R equals the residual.

This value is compared to test values found in a table. The
tabled value chosen depends upon the level of significance chosen,
the number of observations, and the number of independent variables
in the equation. Two figures are found describing the upper and lower
bounds for acceptance or rejection (indicated by d_u and d_1). These
figures are used in determining positive autocorrelation. To find if
negative autocorrelation exists, the bounds are $4-d_u$ and $4-d_1$. The
region of acceptance of the null hypothesis (no autocorrelation), areas
of indeterminancy, and areas of rejection of the null hypothesis (auto-
correlation exists) are easily seen in table 1. The region the d sta-
tistic lies in indicates the results of the test.

Multicollinearity

Intercorrelation among the independent variables creates a prob-
lem in a regression analysis and is often present in economic time
series analyses. Multicollinearity is simply a severe case of inter-
correlation.[1] The result of multicollinearity in a regression analysis

[1]Karl A. Fox, Intermediate Economic Statistics (New York:
John Wiley and Sons, 1968), p. 257.

TABLE 1

Test Regions of the Durbin-Watson Statistic

Value of d	0	d_l	d_u	2	$4-d_u$	$4-d_l$	4
	Positive Autocorrelation	*Indeterminable*		No Autocorrelation	*Indeterminable*		Negative Autocorrelation

Source: Kane, Econometrics, p. 367.

is that the separate effects of the highly correlated variables are not distinguishable. The greater the intercorrelation the more indistinguishable the separate effects of the variables become.

The extent of intercorrelation among the variables can be estimated by the square of their simple correlation coefficient (r^2). Generally, if this coefficient is less than .3, the intercorrelation is not severe and can be ignored. As the coefficient increases, the greater the intercorrelation and the separate effects of these variables on the dependent variables is less accurately reflected by the coefficient of multiple determination (R^2).

A method to eliminate this problem is the use of the direct-indirect effects analysis. This analysis eliminates the effect of intercorrelation from the variables and shows the actual or net effect of each variable upon the dependent variable.

"... the coefficient of multiple determination may be expressed

as the sum of the direct effects of the independent variables and the sum of their indirect effects."[1]

$$R^2 = \text{direct effects} + \text{indirect effects}$$

The calculation of the direct and indirect effects requires the use of the beta (β) coefficients of each variable and the simple correlation coefficients (r). Beta coefficients are the regression coefficients transposed to standard comparable units.[2] The direct effect for each variable is found by squaring its β value. The indirect effect must be calculated for each combination of the independent variables. This consists of multiplying the β value of one variable with that of the other along with the r of the two variables, giving the indirect effect of one or the other. To find the total indirect effect of the two variables, this is multipled by 2 since the joint effect of the first variable with the second on the dependent variable is identical with the joint effect of the second variable with the first.[3] The equation for a regression with three independent variables would look like this:

$$R^2_{1.234} = \left(\beta_{12}^2 + \beta_{13}^2 + \beta_{14}^2 \right) + \left(2\beta_{12}\beta_{13}r_{23} + 2\beta_{12}\beta_{14}r_{24} + 2\beta_{13}\beta_{14}r_{34} \right)$$

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[1]Robert Ferber, Statistical Techniques in Market Research (New York: McGraw Hill, 1949), p. 364.

[2]This is done by multiplying the regression coefficients by the ratio of its respective standard deviation to the standard deviation of the dependent variable.

[3]Ferber, Statistical Techniques, p. 364.

The net effect for each variable is found by adding its direct effect with the indirect effects from the interaction with the other variables; the intercorrelation has been removed. The sum of the net effect will equal the R^2 from the regression analysis, since the intercorrelation does not effect the overall results, but reduces the accuracy of the R^2 attributed to independent variables.

Although the direct effect of a variable can never be negative, the sum of its indirect effects can. If the resulting net effect is negative, the variable is reducing the overall determination of the equation and the analysis would benefit if this variable were dropped.[1]

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[1]Ibid., p. 363.

The Variables

Average Mortgage Interest Rate

This variable reflects the average charge on mortgage loans throughout the United States. The interest rate then indicates the cost of a mortgage to borrowers. As previously pointed out, few buyers can afford to pay for a housing unit without a mortgage. Since the price or cost of a good affects the quantity demanded, the cost of mortgages, reflected by the interest rate, should influence housing starts.

It was deemed important to use a national average mortgage rate to eliminate possible error induced by using a single regional figure. Unlike many types of business loans where the location of the loaning bank and the borrowing business may be far apart, most private mortgages are made by local institutions. Thus, a regional shortage or surplus of available mortgage money could improperly influence the rate. The rate, measured in per cent, for 1953 to 1966 was taken from the Report of the Commission on Mortgage Interest Rates, and for earlier years the figures were obtained from a report on the Study of Mortgage Credit. The series were not from the same source, and had to be spliced. This was done, where over-lapping of the two occurred, by finding the amount, in per cent, that one series was larger than the other. The series giving the more

recent figures was approximately 5 per cent larger than the other.
To obtain a consistent series the earlier figures were inflated by
5 per cent.

Since the interest rate is the cost of a mortgage, it would be
expected to have an inverse relationship on housing starts. More
clearly, the mortgage funds are the product being purchased at the
interest rate, that is, price. There is no reason to suspect that
mortgage funds act differently from most commodities, hence the
hypothesized relationship.

Interest Rate Spread

This variable was chosen to reflect the influence of the Federal
Government's programs such as the FHA and VA. The spread, in
per cent, is actually the difference between the average mortgage
interest rate (described above) and the maximum legal contract rate
on FHA insured loans. Using the spread between the FHA rate and
the average mortgage interest rate rather than the FHA rate itself
can be justified by the following. Institutions that do mortgage lend-
ing would be more concerned with the spread between the going mort-
gage interest rate and the FHA rate, since it would be expected that
the larger the spread the less willing these institutions would be to
make loans under the FHA. This is simply due to the fact that a
large spread would indicate that a conventional loan would be more
profitable. Of course, a spread of some size is acceptable since

the FHA loans are virtually risk free for the lender and this reduc-
tion of risk is worth something to the lender. But as more of a
spread develops, more profit is lost by the lender and at some point,
he can increase his profit by accepting more risk _cum_ higher inter-
est rates. Though the absolute amount of the FHA rate has little
effect, the size of the spread may.

The FHA rate is set by law so there is no problem concerning
consistency in the series. The figure chosen was that of the max-
imum legal rate on a title II mortgage exclusive of insurance and
other charges that are often quoted as part of the final mortgage
rate. This variable can also be used to reflect the VA loan guaran-
tee since changes in the VA rate, set by law, almost always equal
the changes in the FHA rate.

The rates for 1950 to 1966 were obtained from the Report of
the Commission on Mortgage Interest Rates and for earlier years
the Study of Mortgage Credit.

An inverse relationship should exist between this variable and
the number of housing starts. With a large spread, fewer institutions
would be willing to lend at the FHA rate, thus reducing the number
of mortgages and housing starts.

Deficit

To indicate the effect of government fiscal action on the private
economy in general, and housing construction in particular, the full

employment budget ie used.

"A full employment budget surplus -- or potential budget surplus as it is sometimes called -- is defined as the Federal surplus budget, on a national-income-accounts basis, that would be generated by a given budget program if the economy were operating at full employment with stable prices throughout the entire fiscal year."[1] For the calculation of this budget, a 4 per cent unemployment rate (seasonally adjusted) is considered full employment.

The full employment budget is better suited for this analysis since it will give a truer picture of the effect of fiscal policy on the economy. The actual budget may be very misleading regarding the restrictiveness (stimulation) on the economy, because it reflects not only the impact of the budget on the private sector, but via the built-in stabilizers, the effect of the private sector on the budget.[2] "Thus, it is said that a large budget deficit which appears to be very expansionary, may, in fact be merely the end result of a highly restricted budget structure which depresses both economic activity and government revenues."[3] A budget deficit then may be a result of depressed incomes, which lower the value of the taxes that are

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[1]Michael Levy, "The Full Employment Budget Surplus," in Public Finance and Fiscal Policy -- Selected Readings, eds. Joseph Scherer and James A. Papke (Boston: Houghton Mifflin Company, 1966), p. 319.

[2]Ibid., p. 329.

[3]Ibid.

collected. Since expenditures are generally set a year in advance, a planned budget surplus could result in a deficit due to reduced tax receipts. The full employment budget takes situations of this type into consideration and reflects the actual effect of the budget on the economy.

The figures, measured in billions of dollars, are those calculated by the Federal Reserve Bank of St. Louis. Their calculation is consistent with that devised by the Council of Economic Advisers. The estimates have been revised where necessary to maintain consistency in the overall series.[1] This eliminates potential problems due to changes or revisions in the accounting methods.

The effect of fiscal actions on housing starts would be expected to be inverse. As the deficit increases, the budget figure becoming more negative, housing starts should increase. This would be explained by suggesting that a full employment budget deficit indicates an actual expansionary fiscal policy resulting in stimulation to the economy in general and to the housing market in particular.

Marriages

Although this variable is not under direct government control, it was felt that it should be included because of its a priori expected effect upon housing. That is, a family formation (marriage) would

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[1] Calculation of the High-Employment Budget: 1947-1967." Federal Reserve Bank of St. Louis Review, June 1967, Vol. 49 Number 6, p. 7.

demand a new housing unit. As previously pointed out, there is not
general agreement on the effect this variable has upon construction,
and its inclusion is justifiable on these grounds. The data, measured
in thousands, were obtained from the Government's publication of
Vital Statistics of the United States. The expected relationship would
be direct, that is, as marriages increase, housing starts should
increase due to the increased number of family units demanding
housing.

The Money Supply

The money supply is included because of its expected effect on
the amount of mortgage funds available for lending. The data on the
money supply, measured in billions of dollars, were found in the
Federal Reserve Bulletin. The definition on the money supply is as
follows:

> The money supply consists of 1, demand
> deposits at all commercial banks other than
> those due to domestic commercial banks and
> the U.S. Government, less cash items in the
> process of collection and Federal Reserve
> Float: 2, Foreign demand balances at Federal
> Reserve Banks and 3, Currency outside the
> Treasury, Federal Reserve Banks, and the
> vaults of all commercial banks.[1]

It would be expected that a direct relationship would exist between
the money supply and housing starts. As the money supply grows,

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[1]Federal Reserve Board of Governors, Federal Reserve Bulletin,
LI (July, 1965), p. 1740.

more funds would potentially be available for mortgage lending,
providing the ability to purchase more housing units.

The Dependent Variable

Housing Starts

Housing starts is synonymous with the starts of construction
of a housing unit. A housing unit is, "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 quarters such as dormitories, motels,
and also excludes mobile homes.[2] If a multiple unit dwelling is
constructed, all units are counted when work begins. For the pur-
poses of this analysis, construction of public housing units are not
counted, only privately owned units are considered.

The data, measured in thousands, from 1963 to 1966 were
gathered from The 1968 HUD Statistical Yearbook and for earlier
years from Housing Construction Statistics 1889 to 1964.

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[1]U. S. Department of Commerce, Bureau of the Census,
Housing Construction Statistics 1889 to 1964, GPO, 1966, p. 9.

[2]Mobile homes, however, have been becoming more important
as permanent residences and should, no doubt, be included in future
series on housing starts.

CHAPTER 5

RESULTS

The least squares analysis summarized in table 2, indicates that the variable FHA spread adds nearly nothing to the coefficient of determination (R^2). It does, however, reduce the significance of the equation by lowering both the t and F values. A second analysis, deleting the FHA spread, is summarized in table 3.

As can be seen, the R^2 is not reduced. The F ratio significant at the 95 per cent level, and three of the four t values are significant at the 90 per cent level. The Durbin-Watson statistic falls into the indeterminable range, but close to the acceptable range, so the tendency is to accept rather than reject the null hypothesis. The interest rate is responsible for 27 per cent of the determination, half that of the total equation. It also has the highest t and F values. The money supply contributes an additional R^2 of .12. The deficit adds .05 to the R^2, and marriages adds .09. Marriages is the only variable with an insignificant t value.

The simple correlation coefficients indicates an expected, strong intercorrelation between the interest rate and the money supply. To separate the effects of this multicollinearity, the direct-indirect effects analysis is applied. The results are presented in table 4. The net effect is the actual R^2 each variable adds to the equation. Mar-

TABLE 2

Summary of Regression Equation #1

Simple Correlation Coefficients

	X_1	X_2	X_3	X_4	X_5		t Values
X_1	1.000	0.318	0.053	0.089	0.034	X_1	-1.2009
X_2	-	1.000	0.161	0.849	0.515	X_2	2.4380*
X_3	-	-	1.000	0.320	-0.460	X_3	1.2831
X_4	-	-	-	1.000	0.429	X_4	-3.5520*
X_5	-	-	-	-	1.000	X_5	0.0602

Resulting Equation

$$Y = 3102.7390 - 0.3854\,X_1 + 10.5814\,X_2 + 10.5127\,X_3 - 460.3003\,X_4 + 18.0649\,X_5$$
$$(0.3209) \quad\quad (4.3402) \quad\quad (8.1934) \quad\quad (129.5904) \quad\quad (300.0393)$$

$R^2 = .54$

F ratio $= 3.0206$

Y = Housing Starts; X_1 = Marriages; X_2 = Money Supply; X_3 = Deficit; X_4 = Interest Rate; X_5 = FHA Spread

Standard Deviations are in ( ); The t values and F ratio are indicators of significance for the particular variables and overall equation respectively; * indicates significance at the 90 per cent level.

TABLE 3

Summary of Regression Equation #2

Simple Correlation Coefficients

	X_1	X_2	X_3	X_4
X_1	1.000	0.318	0.053	0.089
X_2	-	1.000	0.161	0.849
X_3	-	-	1.000	0.320
X_4	-	-	-	1.000

t Values

X_1	-1.2598
X_2	2.6311*
X_3	1.7383*
X_4	-3.7739*

Resulting Equation

$$Y = 3100.4737 - 0.3875 X_1 + 10.6475 X_2 + 10.1819 X_3 - 458.4615 X_4$$
$$(0.3076) \quad (4.0468) \quad (5.8574) \quad (121.4911)$$

$R^2 = .54$

F ratio = 4.0641*

Y = Housing Starts; X_1 = Marriages; X_2 = Money Supply; X_3 = Deficit; X_4 = Interest Rate

Standard deviations are in ( ); The t values and F ratio are indicators of significance for the particular variable and overall equation respectively; * indicates significance at the 90 per cent level.

TABLE 4

Direct - Indirect Effects

		X_1	X_2	X_3	X_4
Beta Values		-.2621	1.0574	.3457	-1.5041
Direct Effect		.0687	1.1181	.1195	2.2623
I n d i r e c t	X_1X_2	-.0881	-.0881		
	X_1X_3	-.0048		-.0048	
	X_1X_4	.0351			.0351
	X_2X_3		.0558	.0558	
	X_2X_4		-1.3502		-1.3502
	X_3X_4			-.1664	-.1664
Net		.0109	-.2614	.0071	.7808

Total Net Effects = .54

R^2 of equation #2 = .54

X_1 = Marriages; X_2 = Money Supply; X_3 = Deficit; X_4 = Interest rate

riages add a mere 1 per cent. Fiscal actions, indicated by the deficit, also add less than 1 per cent. The interest rate adds 78 per cent to the determination, but the money supply reduces the overall determination by 26 per cent. According to the direct-indirect effect analysis, if any of the variables contribute a negative net effect, it will benefit the overall analysis to remove that variable. [1]

A third analysis is consequently included deleting the money supply. The results are summarized in table 5. The Durbin-Watson statistic falls into the acceptable range (no autocorrelation). The interest rate still adds 27 per cent to the R^2 and has acceptable F and t values. This result is the same as the previous analysis and indicates a problem. The results are not improved by deleting the money supply, as would be expected. The total R^2 falls to .31, and the F ratio is insignificant along with the t values for the deficit and marriages. According to the direct-indirect analysis, this should not occur! Because of this fact, a fourth analysis is made using the original equation transformed to first differences. This is done to eliminate the multicollinearity before the analysis. The results of this run are shown in table 6.

The simple correlation coefficients indicate that there is no appreciable multicollinearity. Again interest rate contributes the largest R^2 with 34 per cent, and its t and F values are acceptable

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[1] Ferber, Market Research, p. 363.

TABLE 5

Summary of Regression Equation #3

Simple Correlation Coefficients

	X_1	X_2	X_3
X_1	1.000	0.053	0.089
X_2	-	1.000	0.032
X_3	-	-	1.000

t Values

X_1	0.0018
X_2	0.9199
X_3	-2.5777*

Resulting Equation

$$Y = 2401.4763 + 0.0006 \ X_1 + 6.1409 \ X_2 - 178.5556 \ X_3$$
$$(0.3187) \qquad (6.6757) \qquad (69.2703)$$

$R^2 = .31$

F ratio = 2.2306

Y = Housing Starts; X_1 = Marriages; X_2 = Deficit; X_3 = Interest Rate

Standard deviations are in ( ); The t values and F ratio are indicators of significance for the particular variable and overall equation respectively; * indicates significance at the 90 per cent level.

TABLE 6

Summary of Regression Equation #4

Simple Correlation Coefficients

	X_1	X_2	X_3	X_4	X_5		t Values	
X_1	1.000	0.354	0.367	0.028	-0.063		X_1	0.2794
X_2	-	1.000	-0.229	-0.235	0.198		X_2	-0.1597
X_3	-	-	1.000	-0.168	-0.367		X_3	0.3586
X_4	-	-	-	1.000	0.371		X_4	-2.2142*
X_5	-	-	-	-	1.000		X_5	0.4411

Resulting Equation

$$Y = 55.0134 + 0.2413\,X_1 - 4.3756\,X_2 + 5.4767\,X_3 - 531.1489\,X_4 + 174.8171\,X_5$$
$$(0.8638) \qquad (27.3934) \qquad (15.2739) \qquad (239.8799) \qquad (396.3115)$$

$R^2 = .36$

F ratio $= 1.3375$

Y = Housing Starts; X_1 = Marriages; X_2 = Money Supply; X_3 = Deficit; X_4 = Interest Rate; X_5 = FHA Spread

Standard deviations are in ( ); The t values and F ratio are indicators of significance for the particular variable and overall equation respectively; * indicates significance at the 90 per cent level.

at the 95 per cent level. The Durbin-Watson statistic falls into the indeterminable range again. It falls very close to the boundary, however, and coupled with the fact that the previous analysis is definitely not autocorrelated, the hypothesis that no autocorrelation exists is accepted. The addition of the remaining variables, however, adds only .02 to the R^2 and reduces the F and t values below acceptability.

CHAPTER 6

CONCLUSIONS AND IMPLICATIONS

Conclusions

Considering the results of the direct-indirect analysis and the
two subsequent regression analyses (deleting the money supply and
the using of first differences), we must doubt the validity of the
hypothesized equation. The additional fact that the "significant"
results only occurred when high multicollinearity is present suggests
that the variables are of questionable influence on housing starts.

This conclusion indicates that monetary policy, as reflected by
money supply, has no appreciable effect upon housing starts. Sim-
ilarly, fiscal actions and the influence of the Federal Government's
FHA and VA programs appear to have little effect upon housing starts.
The results of this study also seem to support Maisel's contention
that family formations have negligible effect upon housing starts.

The reason for the apparent significance of equations 1 and 2
(tables 2 and 3) is not evident. This result may be due to a violation
of the assumptions underlying a least squares multiple regression
analysis as outlined earlier, data error, or simply that the relation-
ship arose by chance.

An additional explanation may be that the multicollinearity was
so severe that the results were affected in ways other than those

previously discussed. It should be noted though that no mention of this possibility was made by Ferber and would indicate that if the data conformed to all the assumptions of least squares, his analytical method should work.

Implications

The purpose of this study is to analyze the effect the government currently has upon housing starts. The results indicate that there is no significant relationship between housing starts and the hypothesized variables. The variable, interest rate, is the exception. Its R^2 ranges from .27 to .34 at significant levels.

Since there does not seem to be any relationship between housing starts and the variables, money supply and deficit, manipulation of these factors should have no appreciable effect upon housing.

Interest rate does show a significant relationship to housing starts. Since it represents part of the cost of a mortgage, it appears to support Guttentag's premise that housing starts are very sensitive to credit terms. Further research into this aspect would be a logical conclusion from this study. The relationship between housing starts and cost factors such as interest rate, size of downpayment, length of mortgage and other pertinent variables is recommended for further study. The results of this type of study would probably be very beneficial to the government in developing future housing policies.

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