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Financial Deregulation, Interest Rates, and the Housing Cycle

Adrian W. Throop*

Thrift institutions supplying nearly half of the total credit needs of housing have experienced recurrent bouts of deposit outflows during periods of high interest rates. Such outflows would have had a significant impact on the pace of residential investment to the extent that the market for mortgage credit was not fully integrated with money and capital markets. In recent years, financial deregulation has tended increasingly to integrate the mortgage market with other financial markets. This article estimates the magnitude of credit availability effects on residential investment from disintermediation at thrifts both before and after financial deregulation, as well as the effect that this deregulation has had on the cyclical volatility of interest rates.

In recent years, financial deregulation has tended to integrate the market for mortgage credit with the money and capital markets. This article examines how the extent of integration has changed the cyclical behavior of interest rates and residential investment.

Three major factors insulated the mortgage market from other financial markets in the past: 1) Regulation Q ceilings on the interest rates paid on deposits at thrift institutions that specialize in housing finance, 2) usury ceilings on mortgage loans, and 3) a limited secondary market for mortgage loans. The disintermediation created by ceilings on deposit rates tended to restrict deposit flows into thrift institutions in periods of tight credit. The thrift institutions had difficulty offsetting the lack of deposit inflows by selling off mortgage loans from their portfolio because of a limited secondary market as well as an unwillingness to show capital losses. Also, usury ceilings reinforced the short-run tendency of mortgage lenders to ration credit by means other than interest rates. To the extent that restrictions on the availability of mortgage credit at thrift institutions could not be offset by other lenders, the result was more severe fluctuations in residential investment.

Since most ceilings on deposit rates and usury ceilings on mortgage rates were removed in the late 1970s and early 1980s, housing should now be able to compete on a more nearly equal basis for funds; and swings in housing construction should be dampened. Nevertheless, housing still is likely to be affected by tight credit conditions more than other sectors of the economy because housing demand has a relatively high sensitivity to interest rates. An additional consequence of financial deregulation should be a greater volatility in the general level of interest rates. This follows because the overall supply of credit is now being rationed to a greater degree by price, and also because tight credit conditions now strike less specifically on housing.[1]

This article estimates the degree to which financial deregulation has both moderated the cycle in residential investment and contributed to greater volatility in market interest rates. Section I provides a simplified theoretical framework for analyzing the effects of tight credit conditions on the cyclical behavior of residential investment and interest rates in regulated versus unregulated financial environments, and discusses its applicability to recent housing cycles. Sections II and III identify past

* Research Officer, Federal Reserve Bank of San Francisco. Research assistance by Hamid-Reza Davoodi is gratefully acknowledged.

periods when regulatory constraints were at least partly binding and disintermediation at thrifts resulted in less residential investment than would have occurred in a deregulated financial environment. To make the identification, a model of the housing market based purely on demand factors was constructed, and then was tested for the additional influence of deposit inflows at thrift institutions during periods of disintermediation.

Next, Section IV compares the cyclical behavior of market interest rates and housing activity in periods of binding regulatory constraints with what they would have been in a deregulated financial environment. For this purpose, the model of residential investment was embedded in a small-scale structural macroeconomic model. The degree to which financial deregulation has made interest rates more volatile and swings in the housing cycle less severe was then simulated by removing the estimated effect of deposit flows on housing activity. Finally, Section V provides a summary of the main findings.

I. The Availability of Credit to Housing

Theoretical Framework

We begin with a simplified theoretical framework for analyzing the effect of regulatory constraints on residential investment. For this purpose, consider a rudimentary financial system in which a regulated set of financial intermediaries provides housing finance, whereas borrowers in other sectors of the economy obtain credit in the open market without the use of intermediaries. The demand for credit in each of these sectors is assumed to be independent of the demand for credit in the other, but suppliers of credit shift freely between the two markets in response to relative interest rates. Without loss of generality, the cost of intermediation is assumed to be zero, so that the supply of deposits to the financial intermediaries is identical with the supply of mortgage credit to ultimate borrowers. We also, at least initially, abstract from problems related to the maturity structure of interest rates.

This model contains two demand functions and two supply functions. The demand for mortgage loans, D_m, depends upon the mortgage rate, i_m, which, in the unregulated financial environment, is equal to the deposit rate, i_d; and the demand for other types of credit, D_o, is a function of the interest rate in the open market, i_o. The supply of credit to financial intermediaries, S_m, and thus ultimate mortgage borrowers, depends upon both the deposit rate, i_d, and the open market rate, i_o. The supply of credit to the open market, S_o, is a function of these two rates as well.

An initial full equilibrium in the two markets is depicted in Panel A of Figure 1, where, for simplicity, we assume that at the outset the deposit rate (and mortgage rate) is the same as the interest rate in the open market. Each of the initial supply functions is drawn on the assumption of an equilibrium value of the interest rate in the other market.

Consider now an increase in the demand for credit in the open market, which has the effect of shifting the demand schedule from D_o to D'_o. In an unregulated financial environment, the resulting higher interest rate in the open market would shift the supply of funds in the intermediated market, S_m, to the left, raising the mortgage rate and deposit rate as well. These higher rates would, in turn, shift the supply of funds in the open market, S_o, to the left and raise the interest rate in the open market still further, and so forth.

The ultimate configuration of interest rates between the two markets depends upon the substitutability in supply between the two markets and the relative elasticities of demand. As long as lenders do not regard market instruments and thrift deposits as perfect substitutes, open market rates would rise by somewhat more than deposit and mortgage rates. Even in the unregulated environment, residential investment would fall as more funds flow toward open market.

The outcome in this unregulated financial environment contrasts with that when a ceiling is imposed on the deposit rate at financial intermediaries at the initial level of interest rates, shown in Panel B. Since the deposit rate cannot change, the

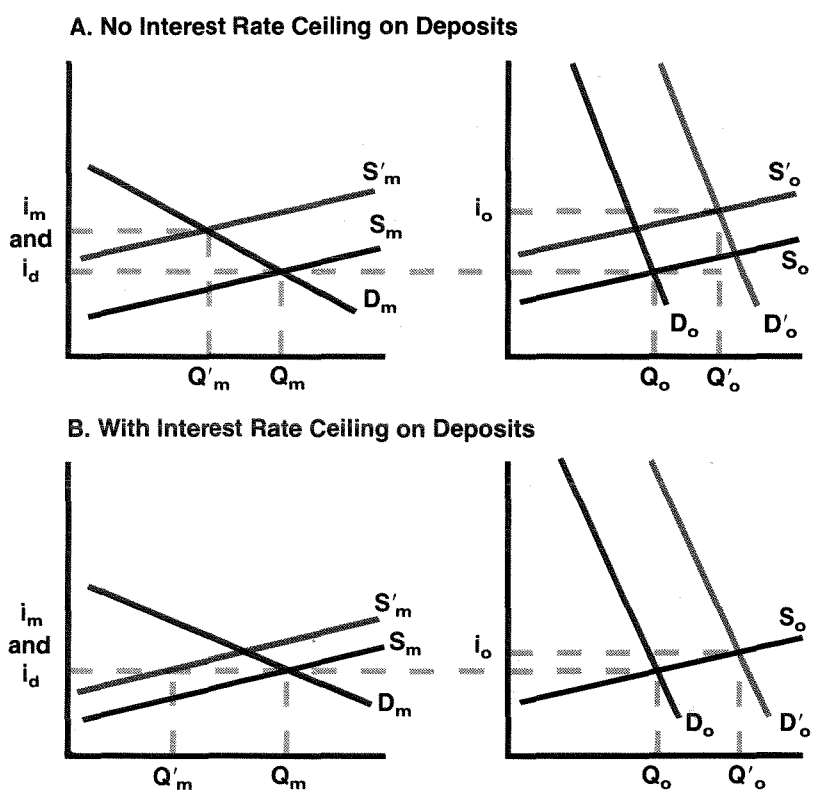
supply schedule for credit to the open market now remains fixed when the demand for credit rises in that market. The resulting increase in the interest rate in the open market then causes a shift of funds away from deposits at intermediaries, and reduces the supply of deposits from S_m to S'_m.

The resulting decline in mortgage credit and housing activity at the controlled level of the deposit rate will be greater than in the case of uncontrolled intermediaries ($Q_m - Q'_m$ is greater in Panel B than in A). Also, the difference in the impact on housing between the regulated and unregulated financial environments will be greater the larger is the substitutability in supply between the two markets.[2]

The deposit rate ceiling reduces residential investment by more than would otherwise occur because of the temporary market disequilibrium and resulting restriction in the availability of credit. Compared to the unregulated environment, interest rates in the open market rise by less. As a result, nonhousing activity rises more, and residential investment therefore falls by more than in an unregulated situation. Note also that, although in this example interest rates rise because of an increase in the demand for credit, a similar difference between controlled and uncontrolled environments exists if interest rates were to rise because of a restriction in the supply of credit (as, for example, due to monetary policy).

The excess of mortgage credit demanded over that supplied, which results from the disequilibrium created by the deposit rate ceiling, must somehow be rationed.[3] If usury ceilings on mortgage loans were binding, mortgage credit would be rationed by means other than the mortgage rate, such as by increasing down payments or simply by refusing to lend. Alternatively, if usury ceilings on mortgage loans were not binding, the mortgage rate could rise

Figure 1
Interest Rate Ceilings and the Availability of Credit to Housing



relative to the deposit rate to ration the available supply of funds. In the short-run, however, mortgage rates are slow to adjust to market forces while other dimensions of price tend to be altered first. Still, the argument about the effect of disintermediation on the availability of credit to housing does not depend on the exact means used to ration the restricted supply of mortgage credit.

This simple model captures the essence of the credit availability effects generated by deposit rate ceilings at thrift institutions. However, because thrift institutions generally supply no more than half of total residential home mortgage credit, these availability effects could be offset by other lenders less subject to deposit rate regulation than thrifts. The extent of offset depends on the substitutability of other investments for mortgage loans. Unless mortgage loans and investments in the portfolios of these other lenders were perfect substitutes, restricting credit availability at thrifts could still have some impact on the total supply of mortgage credit and residential construction.

In addition, thrift institutions themselves may be able to reduce the effects of deposit rate ceilings by tapping alternative sources of funds. If these alternative sources were not perfectly substitutable for regulated deposits, however, some credit availability effects due to disintermediation may remain.

Regulation Q and Government Support of the Mortgage Market

We now turn to a discussion of the degree to which Regulation Q has affected different types of mortgage lenders, as well as the major alternative sources of funds available to thrifts. Regulation Q ceilings were imposed on deposit rates at commercial banks in the 1930s. Their purpose was to prevent excessive competition for funds, which was thought to have been one of the major causes of bank failures. Because market rates of interest typically were below the ceilings, these ceilings had little effect on the financial system until the mid-1960s. As the ceilings became binding, however, they were extended to savings and loan associations and mutual savings banks, although these institutions were given a favorable rate differential over commercial banks in an attempt to protect the flow of housing credit through them. The differential ceilings prevented an outflow of funds from thrifts to banks but did little to prevent outflows into unregulated intermediaries and to the open market during periods of disintermediation in 1966-67, 1967-70, and 1973-74 brought on by rising interest rates.

Commercial banks were generally able to adjust to periods of disintermediation better than thrifts for several reasons. First, in the earlier years, commercial banks had relatively large holdings of government securities that could be sold off to offset the effects of deposit outflows. Second, banks sought to overcome the effects of disintermediation by developing new sources of funds — the most important of which were Eurodollar borrowings and issues of bank-related commercial paper. Third, Regulation Q ceilings were lifted on large negotiable CDs maturing in 30 to 89 days in 1970, and on all such CDs in 1973.

In contrast, thrifts did not have large holdings of secondary reserves. They were slow to develop new sources of funds beyond Federal Home Loan Bank advances, and they did not begin to issue significant amounts of large CDs until the late 1970s. Since thrift institutions are the main suppliers of mortgage credit, there was a potential for significant credit availability effects on residential investment during the periods of disintermediation.

Government-sponsored agencies have pursued activities to offset some of the effects of disintermediation[4]. The most important offset for thrifts has consisted of advances from Federal Home Loan Banks, which tend to rise in periods of disintermediation and weak housing activity, and to fall in other periods. Since Federal Home Loan Banks obtain the funds for these advances by borrowing in the open market — a practice that puts further pressure on market interest rates, their activities have tended to generate further disintermediation at thrifts. Nevertheless, the net effect of Federal Home Loan Bank advances has probably been to reduce credit availability effects on residential investment, at least in the short-run.

The Federal National Mortgage Association (FNMA or "Fannie Mae") and, to a lesser extent, the Federal Home Loan Mortgage Corporation (FHLMC or "Freddie Mac") have also tended to

offset some of the effects of disintermediation. They have done so by issuing debt and using the proceeds to buy mortgage loans from thrifts. Constituting another source of support have been sales of federally guaranteed participations in mortgage pools by the Government National Mortgage Association (GNMA or "Ginnie Mae) and Freddie Mac. These pools, which tap broader sources of mortgage finance than just deposits at thrifts, became important after 1970. However, the activities of FNMA and the other agencies have been less countercyclical than those of the Federal Home Loan Banks.

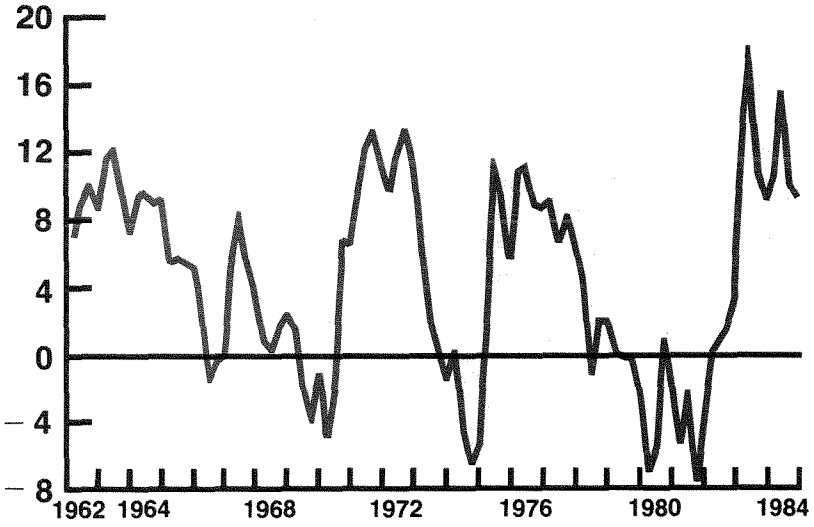
Recent Financial Deregulation

Although the extent of countercyclical support to mortgage finance by government agencies has not changed much in recent years, financial deregulation has integrated the mortgage market more completely with money and capital markets. The first major element of deregulation affecting housing was a relaxation of Regulation Q ceilings in June 1978. This relaxation allowed both thrifts and commercial banks to issue Money Market Certificates with an interest rate tied to the rate on six-month Treasury Bills.[5] Subsequently, the Deregulation and Monetary Control Act of 1980 authorized the phase-out and ultimate elimination of all limitations on interest and dividends paid on deposits and accounts at depository institutions. The phase-out period lasted until April 1986, but substantial deregulation took place almost immediately.[6] In addition, the Deregulation and Monetary Control Act eliminated state usury ceilings for residential mortgage loans and broadened the asset powers of thrift institutions.

These changes have enhanced the ability of thrift institutions to attract funds in periods of tight credit and given them more flexibility in managing their assets. As shown in Chart 1, however, sharp cycles in the flow of real, or inflation-adjusted, deposits to thrifts were not eliminated. Even after the introduction of Money Market Certificates in June 1978, the total flow of real deposits into thrifts varied sharply and inversely with the overall level of interest rates. Nevertheless, the fact that movements in deposit inflows continued to be associated with changes in interest rates does not necessarily indicate that regulation effectively continues to constrain housing finance. Nor are earlier cycles in deposit flows *necessarily* evidence of effectively binding regulatory constraints in those periods.

Deposit inflows to thrifts would tend to follow a cyclical pattern in response to variations in interest rates even in a completely unregulated financial environment. Outflows of deposits could still occur

Chart 1
Real Deposits at Thrift Institutions
(Quarterly Percent Change at Annual Rates)



in such an environment when the *demand* for mortgage finance is curtailed by high levels of mortgage rates, thus reducing the amount of deposits that thrift institutions are willing to supply.

In Section III, we will estimate the impact that regulatory constraints have had on residential investment through restricting the supply of mortgage credit from thrifts. As part of this analysis, we examine whether credit availability effects at thrifts continued to play a role after 1978 or whether the fluctuation in deposit flows at thrifts in the post-1978 years was purely demand-induced.

II. An Empirical Model of Residential Investment

In this section, we develop an econometric model of residential investment in which the demand of housing in combination with the current stock of housing determines the current relative price of housing. The amount of residential investment then responds to the profitability of construction as determined by the relative price of housing[7].

We begin with an analysis of the determinants of the demand for the stock of housing. The per capita real demand for the stock of housing is assumed to depend upon per capita permanent real disposable income and the nominal user cost of capital in housing relative to the general price level. Thus,

$$\frac{K^*}{N} = b_0 \left(\frac{YDP}{N}\right)^{b_1} \left(\frac{P_u}{P}\right)^{-b_2} \qquad (1)$$

where K^* = quantity of housing demanded in 1972 dollars

N = population

YDP = permanent disposable income in 1972 dollars[8]

P_u = nominal user cost of housing capital

P = general price level.

The nominal user cost of housing capital, P_u, is the per period payment for capital and is analogous to a wage rate for labor. In the absence of taxes, the nominal user cost in the current period can be shown to be proportionate to the asset price of housing according to the formula:

$$P_u = P_h(i - \dot{p} + d) \qquad (2)$$

where: P_u = nominal user cost of capital

P_h = asset price of housing

i = market rate of interest

$\dot{p}$ = expected rate of inflation

d = rate of physical depreciation of housing assets.

Thus, the nominal user cost, P_u, equals some fraction of the asset price of housing, P_h, determined by the market rate of interest, i, the expected rate of inflation, $\dot{p}$, and the rate of physical depreciation, d. The rate of interest, i, is equal to the nominal cost of capital so that $i - \dot{p}$ is the corresponding real long-term rate of interest.[9] The ratio of the nominal user cost to the asset price of housing (equal to $i - \dot{p} + d$) is referred to as the real user cost, UC.

The real user costs for owner-occupied and rental units differ because of the effects of taxation.[10] We employ a weighted average of these costs — with weights of three-fourths and one-fourth, respectively — to obtain the aggregate real user cost, UC. P_u from equation 2 can then be substituted into equation 1 to obtain:

$$\frac{K^*}{N} = b_0 \left(\frac{YDP}{N}\right)^{b_1} \left(\frac{UC \cdot P_h}{P}\right)^{-b_2} \qquad (3)$$

or

$$\ln K^* = \ln b_o + (1 - b_1) \ln N + b_1 \ln YDP - b_2 \ln UC - b_2 \ln\left(\frac{P_h}{P}\right) \qquad (3a)$$

Thus, the stock of housing demanded is a function of population, permanent disposable income, and the real asset price of housing, as well as tax factors, the depreciation rate, and the real interest rate contained in the real user cost ratio, UC.

In the short-run, the current stock of housing, K, is fixed, and the real asset price of housing, P_h/P, adjusts to clear the market for housing, as shown in Panel A of Figure 2. Setting K equal to K* and rearranging terms, this equilibrium condition implies:

$$\ln\left(\frac{P_h}{P}\right) = \frac{1}{b_2}\ln b_o + \frac{1-b_1}{b_2}\ln N + \frac{b_1}{b_2}\ln YDP - \ln UC - \frac{1}{b_2}\ln K \qquad (4)$$

With a given stock of housing, an increase in population or permanent income drives up the real asset price of housing until the higher relative user cost equates the quantity demanded with the available stock. Conversely, an increase in the current housing stock reduces the real asset price, and hence the relative user cost, until the increase in the quantity demanded equals the increase in the stock available. Finally, a change in the real interest rate, the effective tax on the cost of capital, or the depreciation rate would produce offsetting changes in the real asset price of housing until the relative user cost is the same as before.

The supply of residential investment in the model is characterized by a conventional supply function. Because of capacity constraints, marginal costs increase with the rate of construction. The amount of building is therefore an increasing function of the real asset price of housing, scaled by the size of the existing capital stock:

$$IFIXR = a_o\left(\frac{P_h}{P}\right)^{a_1} K \qquad (5)$$

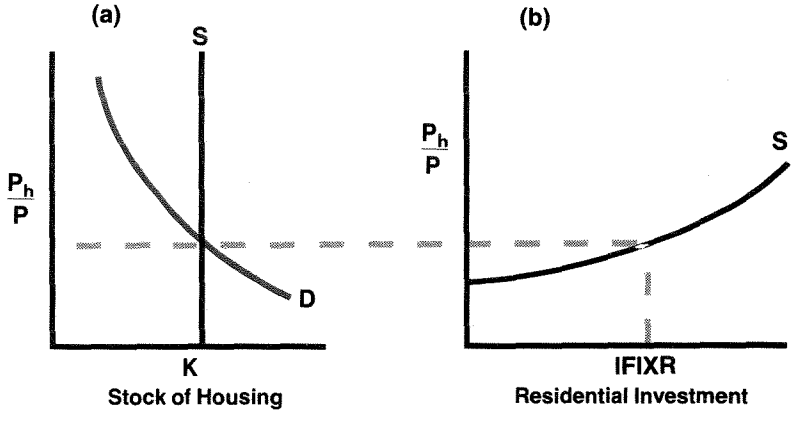
or

$$\ln IFIXR = \ln a_o + a_1 \ln\left(\frac{P_h}{P}\right) + \ln K \qquad (5a)$$

This supply function for residential investment is shown in Panel B of Figure 2. Gross real residential investment can therefore be obtained by substituting the determinants of the real asset price of housing in equation 4 into equation 5a, giving.

$$\ln IFXR = \ln a_0 + \frac{a_1}{b_2}\ln b_0 + \frac{a_1}{b_2}(1-b_1)\ln N + \frac{a_1 b_1}{b_2}\ln YDP - a_1 \ln UC + \left(1 - \frac{a_1}{b_2}\right)\ln K \qquad (6)$$

Figure 2
The Model of Residential Investment



Several modifications were made to this basic equation to reflect institutional realities in the housing market. First, a dummy variable, CC, having a value of 1 for the second and third quarters of 1980 and zero otherwise, was added to capture the effect of President Carter's credit control program that caused a temporary decline in the availability of credit. Second, all the explanatory variables were lagged three quarters to allow for an interval between a change in underlying supply and demand conditions and the response of housing asset prices and building activity.

A third modification was a change in the measurement of the real user cost. In principle, this measurement should contain the real after-tax mortgage rate and non-price terms of mortgage credit. However, mortgage rates tend to move sluggishly, with most adjustment in the short-run taking place in the hard-to-measure nonprice terms of credit. Therefore, a distributed lag on the real after-tax 6-month commercial paper rate was used instead.[11] The real after-tax commercial paper rate was first used to define the user cost for owner-occupied and rental housing. Then the resulting real aggregate user cost, UC, was entered into the investment equation in distributed lag form. The best fitting distributed lag was three quarters in length. This lag covers the interval between changes in short-term interest rates and the response in the cost of mortgage credit as well as the time it takes for builders to respond to the resulting change in housing prices. Also, short-term interest rates enter directly into the construction costs of builders.

III. Testing for Credit Availability Effects

The model of residential investment in the preceding section assumes that housing construction is driven by the demand factors determining housing prices and the response of builders to the profitability of new construction. The availability of credit to housing was not viewed as an additional constraint on residential investment. More specifically, the real after-tax interest rate in the real user cost of housing capital was assumed to depend only upon open market interest rates (as represented by the 6-month commercial paper rate) and not on variables specific to housing.

Previous researchers, in contrast, have found evidence of significant credit availability effects on residential investment in three periods: 1966.Q3-1967.Q1, 1969.Q3-1970.Q3, and 1973.Q4-1975.Q2.[12] As shown in Chart 1, these periods correspond to times of severe disintermediation at thrift institutions, when Regulation Q ceilings were binding and growth in real deposits fell to less than a 1-percent annual rate. If restrictions on credit availability resulting from deposit outflows were not fully offset by adjustments of thrift institutions themselves or by increased quantities of credit from other lenders in the mortgage market, the user cost of housing capital would rise by significantly more than open market interest rates in these periods. A greater reduction in housing demanded and residential investment than could be captured by the model would result; and the model's prediction error in these periods would tend to be associated with the extent of deposit outflows.

Even after the major relaxation of Regulation Q ceilings in June 1978 that allowed the introduction of Money Market Certificates, thrift institutions suffered another major slowing in deposit flows between 1979.Q3 and 1982.Q1. For this most recent period, a question of particular importance is whether the remaining regulatory constraints contributed significantly to the slowdown in deposit flows or whether the slowdown reflected only the response of housing *demand* to variations in the general level of real interest rates. As shown earlier, even in an unregulated market, thrift institutions would be expected to raise their deposit rates less than other market rates when higher real interest rates produce a contraction in residential investment. Deposit flows would slow as a result, even in the absence of significant credit availability effects on housing.

We tested for the presence of credit availability effects on residential investment by adding variables to the basic model that have values equal to the percentage change in real deposits at thrift institutions, lagged either 1 or 2 quarters (DF1 and DF2), for each period of severe disintermediation, and a

value of zero otherwise.[13] The same deposit flow variables for all the other remaining quarters (DF1:OTHER and DF2:OTHER) were also included as controls to make sure that lagged deposit flows were not picking up normal variations in residential investment not adequately captured by the basic model. Finally, since the relationship between credit availability effects and deposit flows is hypothesized to be a marginal one occurring only in periods of severe disintermediation, dummy variables (DUM) allowing for shifts in the intercept term were also entered for each period of severe disintermediation. The resulting estimate of the complete model (with t statistics given in parentheses) is shown as equation 1 in the table.

The explanatory variables in the basic model all have theoretically plausible signs and are statistically significant at greater than the 1 percent level. In addition, the Carter credit controls have a significant impact, even if only for a brief period. Most importantly, the deposit flow variables measuring potential credit availability effects on residential investment are statistically significant at either 1 or 2 lags in each of the first three periods of severe disintermediation, but not in the fourth period that occurred after the introduction of Money Market Certificates in 1978.

Although the deposit flow variable at 2 lags in the first period of disintermediation (DF2: 66-67) is significant at only the 15 percent level in equation 1 of the table, it becomes significant at better than a 1 percent level when other insignificant variables are dropped, as shown in equation 2 of the same table. The deposit flow variable at 2 lags for the third period of disintermediation (DF2: 73-75) is significant at only the 10 percent level in both equations 1 and 2. To simulate the effect of financial deregulation, we accept the hypothesis of credit availability effects in that period even though the statistical basis for doing so is somewhat weak. This assumption tends to maximize the potential effect that financial deregulation can have on the simulated behavior of the economy.

Finally, neither of the deposit flow variables for the remaining quarters (DF1:OTHER and DF2:OTHER) is statistically significant. The lack of statistical significance for these control variables indicates that the deposit flow variables in periods of

Estimated Model of Real Residential Investment

(Sample Period: 1962.Q1 - 1984.Q4)

Terms	Equation 1	Equation 2
Constant	−85.0 (−3.35)*	−80.1 (−3.65)*
$\ln N_{-3}$	12.7 (3.60)*	12.0 (3.96)*
$\ln YDP_{-3}$	2.21 (2.38)*	2.58 (3.19)*
$\sum_{i=0}^{3} \ln UC_{-i}$	−1.05 (−4.13)*	−1.15 (−5.55)*
$\ln K_{-3}$	−11.0 (−3.85)*	−10.7 (−4.40)*
CC	−.125 (−3.43)*	−.127 (−4.38)*
DF1: OTHER	−.0226 (−.169)	
DF2: OTHER	−.0551 (−.411)	
DUM: 66-67	−.104 (−3.46)*	−.107 (−3.84)*
DF1: 66-67	−2.14 (−.497)	
DF2: 66-67	1.53 (1.11)	2.22 (3.56)*
DUM: 69-70	−.0142 (−.524)	
DF1: 69-70	1.53 (2.69)*	1.52 (3.13)*
DF2: 69-70	.182 (.409)	
DUM: 73-75	−.00402 (−.134)	
DF1: 73-75	−.00392 (−.00751)	
DF2: 73-75	.631 (1.23)	.554 (1.22)
DUM: 79-82	.00521 (.180)	
DF1: 79-82	−.0136 (−.0282)	
DF2: 79-82	.285 (.686)	
e_{-1}	1.25 (11.0)*	1.21 (11.2)*
e_{-2}	−.302 (−2.80)*	−.265 (−2.61)*
R^{-2}	.965	.969
SER	.0352	.0334
D.W.	2.09	2.07

t-statistics in parentheses.
*Significantly different from zero at the one percent level.

severe disintermediation are not simply picking up normal variations in residential investment not adequately captured by the basic model.

Thus, the evidence indicates that financial regulation created distinct credit availability effects during periods of severe disintermediation at thrifts prior to 1978 but not afterwards, and that the extent of these credit availability effects was closely related to marginal variations in deposit inflows.[14]

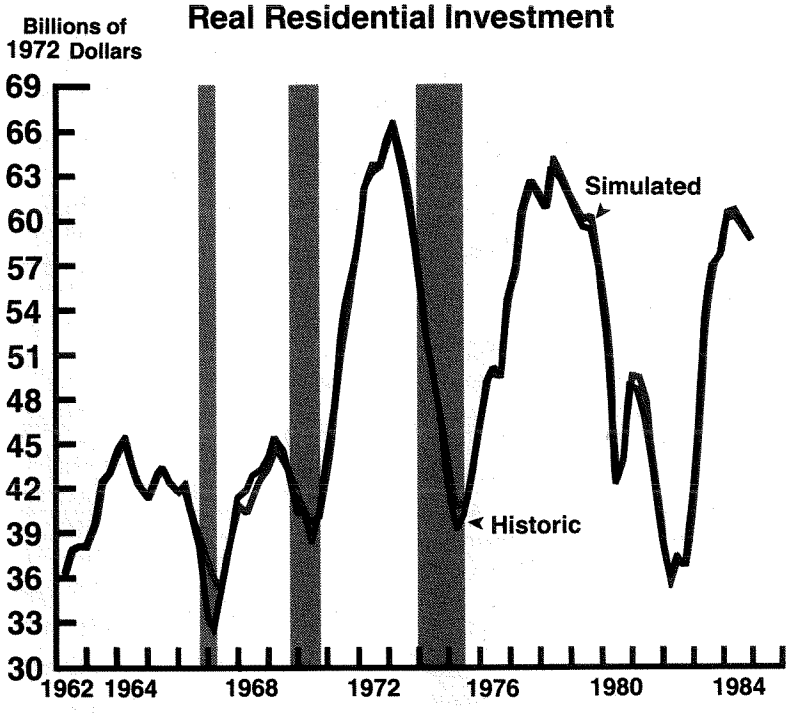
IV. Simulated Effects of Financial Deregulation

Although credit availability effects on housing appear to have been present in periods of disintermediation prior to 1978, the quantitative magnitude of these effects and their impact on the cyclical behavior of both residential investment and interest rates remains to be examined. For this purpose the model of residential investment estimated in equation 2 of the table, including significant deposit flow effects, was embedded in a small-scale structural model of the economy.[15] Historical errors in each equation of the model were added back so that a dynamic simulation could replicate history exactly. Then, the degree to which financial deregulation would have made interest rates more volatile and lessened the severity of the housing cycle was determined by setting the coefficients of the deposit flow variables (including intercept dummies) in equation 2 equal to zero and re-simulating the model. The paths of monetary growth, as measured by M1, and all other exogenous variables were kept unchanged in the simulation, giving interest rates full scope to adjust.[16]

The key short-term interest rate in the model that drives the general level of interest rates is the 6-month commercial paper rate. Charts 2 and 3 show the difference between the historical paths of real

Chart 2

Real Residential Investment



Shaded areas represent periods of estimated credit availability effects.

residential investment and the real 6-month commercial paper rate over the 1962 to 1984 period compared to those resulting from the simulation where no credit availability effects are allowed to operate through deposit flows. In that simulation, the lack of any credit availability effects directed specifically at housing in periods of tight credit reduces the cyclical variability of residential investment. While the absence of such credit availability effects put greater pressure on the general level of interest rates in those periods, it also tends to dampen interest-sensitive expenditures in *all* sectors of the economy and not in housing alone. The result is a net benefit for housing as the impact of tighter credit conditions is more evenly distributed.

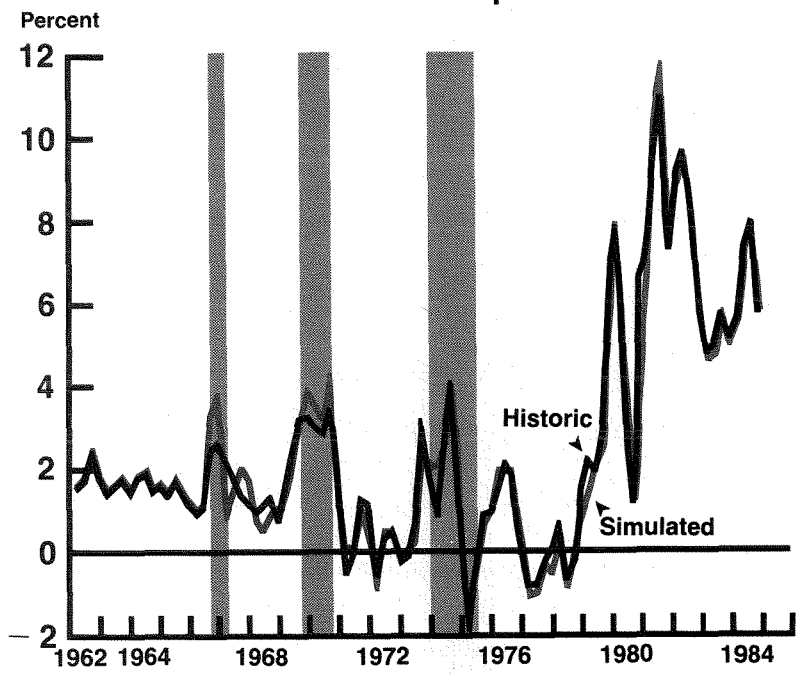
An absence of credit availability effects was simulated to increase residential investment by up to 12 percent in some quarters during the periods of severe disintermediation in 1966.Q3-1967.Q1, 1969.Q3-1970.Q3 and 1973.Q4-1975.Q2. However, because of the overall sensitivity of the demand for housing to interest rates and the fact that Regulation Q ceilings were binding during only part of the historical period, the reduction in the *overall* cyclical variability of residential investment resulting from the elimination of credit availability effects is estimated to be relatively small.

A quantitative measure of cyclical variability is the standard deviation in percentage terms of a variable from its trend. The lower this standard deviation, the less the variability. For the period 1966 to 1975, the standard deviation of residential investment from its trend fell from 18.9 percent to 18.3 percent in the simulated absence of credit availability effects, reducing overall variability by only 3.2 percent.

Both this statistic and a visual examination of Chart 2 confirm that the major reason for cycles in residential investment in the past has been the relatively high sensitivity of housing demand to interest rates rather than the credit availability effects caused by interest rate ceilings and other financial regulations.

Chart 3

Real Commercial Paper Rate



Shaded areas represent periods of estimated credit availability effects.

At the same time that it has reduced the variability of residential investment, financial deregulation has increased the volatility of interest rates. The simulation shows that, in the absence of the credit availability effects associated with interest rate ceilings and other financial regulations, real interest rates would have risen by somewhat larger amounts in periods of tight credit. However, because credit availability effects are estimated to be quite small, the overall increase in the variability of real interest rates is also relatively small. Thus, in the 1966 to 1975 period, the standard deviation of the real commercial paper rate from its mean rose from 131 basis points in the historical observation to 141 basis points in the simulation, giving only a 7.6 percent increase in the variability of real short-term interest rates.

The removal of credit availability effects in past periods of tight credit would have raised real GNP somewhat in those periods. This is because the boost to interest rates from eliminating credit availability effects would have raised the income velocity of M1. With an unchanged path of growth for M1, the rise in its income velocity would have raised the level of GNP. Thus, the higher level of residential investment would not have been fully offset by reductions in other types of interest-sensitive expenditures. Since periods of significant credit availability effects tended to coincide with either growth recessions or actual recessions, financial deregulation would have had an overall stabilizing effect on the economy. The overall degree of cyclical variability as measured by the standard deviation of real GNP from trend in percentage terms would have been reduced only slightly, however — from 3.0 percent to 2.97 percent in the simulation. Thus, we estimate that eliminating credit availability effects would have stabilized the economy as a whole to an even smaller degree than it would have moderated cycles in residential investment.

V. Conclusions

Thrift institutions supplying nearly half of the total credit needs of housing have experienced recurrent bouts of deposit outflows during periods of high interest rates. Earlier periods of disintermediation at thrifts appear to have been related mainly to the effects of Regulation Q ceilings. However, even after the substantial relaxation of Regulation Q ceilings in 1978 allowing the introduction of Money Market Certificates, thrifts experienced deposit outflows in the next period of high interest rates. Manifestly, disintermediation at thrifts can occur with or without pervasive Regulation Q ceilings. Indeed, since residential investment is highly interest-sensitive, strong cycles in deposit flows at thrifts would be expected to occur even in completely unregulated markets since the thrifts' needs for deposits vary with the amount of mortgage loans demanded.

In general, analysts have linked significant credit availability effects on residential investment with earlier periods of disintermediation. However, even in those periods of disintermediation, the flow of credit to housing need not have been reduced if thrifts could have sold off assets in secondary markets or borrowed from government agencies while other lenders provided alternative sources of housing finance. Similarly, the disintermediation occurring at thrifts after 1978 does not necessarily indicate significant credit availability effects. The extent of credit availability effects in both the earlier and more recent periods is an empirical issue.

We have tested for the influence of disintermediation at thrifts on residential investment in the context of an econometric model of the housing market. Statistically significant credit availability effects on residential investment were found for the periods of 1966.Q3-1967.Q1, 1969.Q3-1970.Q3, and 1973.Q4-1975.Q2, but not for the most recent period of disintermediation, 1979.Q3-1982.Q1, which followed a substantial relaxation of Regulation Q.

Regulatory restrictions are estimated to have reduced residential investment by up to 12 percent in some quarters during the three earlier periods. However, those periods were relatively short, and residential investment is highly cyclical even in the absence of credit availability effects. As a result, we estimate regulatory restrictions to have accounted for only about 3 percent of the total variability of residential investment in the 1965 to 1975 period.

Credit availability effects on housing, when they were found, were estimated to have reduced the overall variability of real short-term interest rates by only 7 to 8 percent. This reduction in the volatility of interest rates resulted from financial regulations that tended to concentrate the effects of tight credit on residential investment. Conversely, financial deregulation since the mid-1970s has increased the volatility of interest rates, but only to the same modest degree of 7 to 8 percent. The much higher variability in real interest rates experienced since the late 1970s cannot be explained by the estimated effects of financial deregulation.

FOOTNOTES

1. More than a decade ago, Duesenberry (1969) anticipated that financial deregulation would result in more variation in interest rates over the business cycle. More recent discussions of this point are Lombra (1984) and Keaton (1986). The quantitative importance of this effect has been a matter of considerable dispute, however. Two extreme views are Arcelus and Meltzer (1973) and Wojilower (1980).

2. These two points are most easily demonstrated in the simplest case where the total supply of credit to the two markets is fixed. Since there is a smaller increase in open market interest rates, and hence movement along the demand curve, D'_o, when the deposit rate is controlled, there is a larger increase in credit supplied to the open market. Given that the aggregate supply of credit is fixed, the quantity of credit supplied to the mortgage market must then fall to a larger extent when deposit rates are regulated.

Introducing some positive response of the total supply of credit with respect to interest rates increases the size of the impact of deposit rate ceilings on the availability of credit to housing. In this situation, the amount of credit available to the mortgage market declines by more when deposit rates are regulated not only because the rise in the interest rate paid by the competing open-market sector is less, but also because the total amount of credit available to both sectors is reduced by the relatively lower interest rate.

3. The important distinction between this type of disequilibrium credit rationing and that which can occur even in market equilibrium is discussed in Baltensperger (1978).

4. Useful surveys of the impact of government-sponsored agencies on the mortgage market include Grebler (1977), Hicks (1978), and Hendershott and Villani (1977, Ch. 3).

5. The effect of the introduction of Money Market Certificates on housing starts in the 1978-79 expansion has been explored in Jaffee and Rosen (1979). A limitation of this study is that the introduction of Money Market Certificates is assumed to have no effect on the general level of interest rates. More specifically, in their simulation, the Federal Reserve is assumed to follow an interest rate target. However, when the Federal Reserve targets the stock of money, rather than interest rates, the stimulus to housing from the introduction of Money Market Certificates (or other relaxations of restrictive regulations) would be blunted by upward pressure on market interest rates. The present study allows for such interest rate effects by incorporating a model of residential investment into a complete macroeconomic model.

6. The details and economic implications of the Deregulation and Monetary Control Act of 1980 are analyzed in Cargill and Garcia (1982).

7. For further elaboration of this approach, see De Leeuw and Gramlich (1969) and Kearl (1979).

8. Permanent disposable income is calculated as a 15-quarter distributed lag on disposable income with geometrically declining weights adjusted for the trend in income:

$$YDP = \sum_{i=0}^{15} (1-\alpha)\,\alpha^i\,(1+T)^i\,YD_{-i}$$

The parameter α, chosen to minimize the error in the equation, is equal to 0.5.

9. Hall (1977) and Jorgensen (1963) offer a different interpretation of this formula in which the appropriate interest rate is the real short-term rate even though the capital good is a long-lived asset. For criticisms of their approach and support for the more traditional one, see comments and discussion in Hall (1977) and Throop (1984).

10. Income from rental housing is taxed at the rate, c, applicable to either corporate or individual income after deductions are made for depreciation. If the present value of depreciation allowances per dollar of investment is denoted by z, the nominal user cost of capital invested in rental housing can be shown to be:

$$P^r_u = P^r_h\left[\frac{(1-cz)}{1-c}\right][(1-c)i - \dot{p} + d + tp(1-c)] = P^r_h \cdot UCR$$

where tp is the property tax rate.

The return on owner-occupied capital takes the implicit form of the services provided, and therefore is not taxed. Consequently, the nominal user cost of owner-occupied housing capital is:

$$P^o_u = P^o_h[(1-t)i - \dot{p} + d + tp\,(1-t)] = P^o_h \cdot UCO$$

The appropriate tax rate, t, for owner-occupied housing is the average marginal tax rate for households, while the higher valued corporate tax rate is used for rental housing. For derivations of these formulas, see Ott, Ott, and Yoo (1975) or Throop (1984).

Data on the stock of housing, the corporate tax rate, the property tax rate, and the present value of depreciation come from the Board of Governors. The data series for the average marginal tax rate on household income is from Barro and Shahasakul (1983). The latter series has been updated by the Economics Research Group of Goldman Sachs and the author.

11. The estimated equation for forecasting U.S. inflation over the maturity of the 6-month commercial paper rate is:

$$\dot{p}_{i+2} = \underset{(-.486)}{-.141} + \underset{(3.11)}{.463}\sum_{i=0}^{16} M1_{-1} + \underset{(4.24)}{.552}\sum_{i=0}^{10} \dot{p}_{-i}$$

$$R^2 = .812 \quad S.E. = 1.26 \quad D.W. = 1.09$$

Equations based on monetary growth overpredict inflation in 1982 and 1983 by a substantial margin because of an unusual decline in M1 velocity. However, because the demand for M1 was stable, the decline in M1 velocity can be explained statistically by the decline in inflation and nominal interest rates that occurred in the period. When M1-growth is adjusted for this effect, it continues to predict the growth of nominal income and inflation reasonably well. Consequently, for this period, an adjusted M1-growth was used in the inflation forecasting equation instead of actual

M1-growth. The adjustment factors that were used are described in Judd and McElhattan (1983). For an analysis of the effect of the decline in velocity on inflation and why it occurred, see Throop (1984a,b).

The expected inflation term in the real interest rate was given a weight of only one-half, which effectively weights the real interest rate by one-half and the nominal interest rate by one-half. This weight was determined by fitting the model with weights on expected inflation ranging from zero to one. The significance of the nominal interest rate is due to the fact that a higher ratio of nominal mortgage payments to current income makes borrowers less able to borrow and lenders less willing to lend.

12. See, for example, the housing sector in the MPS econometric model of the U.S. economy, as described in Brayton and Mauskopf (1985).

13. The exact periods of severe disintermediation are defined as intervals of less than 1-percent growth in real deposits with a 1-quarter lag to allow for the time between a change in deposit flows and significant effects on expenditures.

14. These results do not appear to be particularly sensitive to the precise methodology used. For example, ordinary dummy variables take on significantly negative signs during the first three periods of severe disintermediation, but are not generally significant in either the fourth period of severe disintermediation or in the control period. Moreover, the size of the estimated quantitative effects on residential investment in the first three periods obtained by using dummy variables is roughly the same as that estimated with deposit flow variables.

The finding of an absence of credit availability effects after 1978 is consistent with the work of Jaffee and Rosen (1979) and Furlong (1985). Jaffee and Rosen found that the growth rate of small-denomination deposits at savings institutions had a significant impact on mortgage rates prior to 1979, but Furlong shows that this relationship ceased to hold in subsequent years.

15. The theory underlying the model follows the mainline neo-Keynesian view embodied in most large-scale structural econometric models. In the short-run, the slow speed of adjustment of wages and prices allows monetary policy and other factors to influence real interest rates, which, in turn, drive real aggregate demand and output. However, in the long-run, real interest rates are determined by the balance between saving and investment at full employment. Particular attention is paid in the model to the way that real interest rates enter into the cost of capital for specific types of investment.

An earlier version of this structural model of the economy is described in summary form in Throop (1985) and in greater detail in Throop (1984c). Both publications are available upon request. Additional equations for the demand for M1, the unemployment rate, the share of personal disposable income in GNP, and the inflation rate have been included in the current version of the model. A complete description of the current version and simulations of its dynamic properties will be published in a forthcoming issue of the *Economic Review*.

16. Actual values of M1 could not be reproduced exactly in this simulation of the effects of deregulation because of the dynamic properties of the model. Interest rates affect both the demand for M1, given the level of income, and the level of income itself, with distributed lags. Thus, only a fraction of the total direct and indirect effects on M1 from a change in interest rates occurs within the current period.

If interest rates were changed enough to hit an M1 path exactly in the current period, then the lagged effects of the change in interest rates would have to be offset in future periods, resulting in future interest rate movements in the opposite direction. To reproduce the M1 path exactly in each period may require ever larger changes in interest rates over time. This is an example of instrument instability. See, for example, Holbrook (1972). A degree of interest rate smoothing was therefore required. Still, the average deviation of simulated M1 from historical M1 was only half a billion dollars.

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