Debt, Price Flexibility and Aggregate Stability

by

John Caskey* and Steven Fazarri

Working Paper No. 52

April 1991

Prepared for presentation at "The Crisis in Finance," a Conference of The Jerome Levy Economics Institute, Bard College.
* Department of Economics, Swarthmore College and Department of Economics, Washington University-St. Louis, respectively.
We would like to thank Laurence Meyer, Hyman Minsky and James Wilcox as well as seminar participants at Indiana University, the Federal Reserve Bank of Kansas City, Swarthmore College, and Washington University for helpful comments and discussion.

Abstract

In conventional macroeconomic thought, price flexibility stabilizes the economy. The more quickly prices fall (or inflation decreases) in a demand-induced recession, the faster output returns to its full-employment level. An alternative tradition, however, suggests that price flexibility can be destabilizing. If a recession reduces expectations of *future* prices, this can raise current real interest rates and dampen aggregate demand. In addition, as actual *current* prices fall in a recession, real debt burdens rise which can reduce aggregate demand due to financial distress or the response of capital markets. This paper presents simulations from a dynamic macroeconomic model designed to examine the empirical effects of price flexibility. Our results show that, for credible specifications and parameter values, the destabilizing effects of greater price flexibility can be larger than the conventional stabilizing channels. Therefore, it is possible that greater price flexibility *magnifies* the severity of economic contractions initiated by negative demand shocks.

I. Introduction

In conventional macroeconomic models, price flexibility stabilizes the economy. If there is a decline in aggregate demand, the more quickly prices fall (or inflation decreases), the faster output returns to its full-employment level. The theoretical basis for this result is well known. The "Keynes effect," for example, implies that falling prices increase the real money supply, reduce interest rates, and stimulate aggregate spending. A second channel through which falling prices may increase aggregate demand is the "Pigou" wealth effect. As prices fall, the public's real outside money balances increase. The rise in wealth increases consumption (Patinkin, 1948). According to these theories, if prices adjust more quickly in response to output gaps, the economy returns more quickly to long-run equilibrium.[1]

At least since the time of Irving Fisher (1933), however, some economists have argued that falling prices and declining inflation might *not* increase aggregate demand. The reasons for this conclusion vary. One line of thinking emphasizes that expected deflation can raise real interest rates, thereby contracting demand.[2] In such models, the nominal interest rate is determined by asset market equilibrium as in the IS/LM formulation. A negative aggregate demand shock creates expectations of falling prices in the future. This anticipated slowing of future inflation increases current *real* interest rates and further reduces current aggregate demand. The greater the anticipated response of inflation to demand shocks, i.e., the greater the predicted flexibility of prices, the more *destabilizing* this "real interest effect" will be.

An alternative tradition, following Fisher's original ideas, emphasizes that deflation can reduce aggregate demand if bankruptcy and financial distress are costly and nominal debt contracts are widespread.[3]

---

[1] If nominal exchange rates remain constant, falling prices can also increase aggregate demand through foreign trade effects. As exports become relatively cheaper abroad and imports relatively more expensive, aggregate demand expands for domestic goods. These effects would not occur if nominal exchange rates moved to maintain purchasing power parity.

[2] This point is made in Tobin (1975). It has also recently been emphasized by DeLong and Summers (1986b), Chadha (1989), and Zarnowitz (1989) and plays a role in the model of Flemming (1987). Driskill and Sheffrin (1986) present a model with a slightly different structure than that in DeLong and Summers (1986b) in which price flexibility is stabilizing.

[3] This "debt-deflation" point is also considered by Keynes (1936, chapter 19), Davidson (1972), Minsky (1975), Tobin (1980), and Caskey and Fazzari (1987). Related ideas are discussed by Mishkin (1976, 1978), Friedman (1986), Hahn and Solow (1986), Howitt (1986), and Flemming (1989).

In contrast to the real interest rate effect, these models do not work through expectations of future deflation; it is the actual, current price decline that causes the demand contraction. The key idea is that when prices fall below levels anticipated when debts were contracted, debtors' nominal cash flow falls faster than their nominal debt service commitments. Thus, margins of safety for debt payments deteriorate. To avoid the costs of bankruptcy, debtors respond by reducing expenditure. Creditors benefit from the unanticipated gain in the real value of nominal debt, but the increased threat of bankruptcy and the costs associated with it reduce this gain. Therefore, the rising threat of bankruptcy causes a perceived reduction in net wealth. Increases in creditors' expenditure will not offset the decline in debtors' expenditure, and aggregate demand falls.[4] Furthermore, systemic factors, such as adverse selection problems in credit markets or a "flight to quality" that changes the relative price structure of assets, also may reduce expenditure and reinforce the contractionary effects of falling prices.[5] Following tradition, we call this financial channel through which price flexibility affects macroeconomic stability the "debt deflation effect."[6]

Therefore, in spite of the widespread acceptance of an inverse relation between the price level and aggregate demand, the theoretical effect of lower prices on expenditure, and thus the role that price flexibility plays in macroeconomic stability, is ambiguous. The issue must be addressed empirically. In this paper we develop a small dynamic model that incorporates various channels through which aggregate price flexibility affects output. We then simulate the effect of changing the degree of price flexibility for a range of parameters that characterize the U.S. economy. The approach is structural; the various sources of output movements

---

[4] Tobin (1975) gives another justification for the view that falling prices reduce aggregate demand when debt has fixed nominal terms. Tobin argues, following Keynes and others, that debtors have higher marginal propensities to spend than creditors. Consequently, a fall in the price level relative to what agents expected when they contracted their debts, transfers wealth from debtors to creditors and reduces aggregate demand. It is difficult to empirically evaluate this idea directly because aggregate consumption data cannot be easily decomposed into debtor and creditor expenditure. This effect, however, would make the destabilizing effects of price flexibility stronger than those presented here.

[5] Bernanke (1983) and Caskey and Fazzari (1987) present a more detailed discussion of the microeconomic bases for these effects as well as more extensive references.

[6] Substantial increases in measures of indebtedness during the 1980s have focused attention on these issues, especially the risks they create for future recessions. See Bernanke and Campbell (1988) for a detailed discussion.

induced by price flexibility can be identified, and their individual impact on the system's stability can be isolated.[7]

The results of this simulation study provide support for the view that increased price flexibility can *increase* the output loss arising from aggregate demand contractions. For some parameter values, the dominant influence is the real interest rate effect. When inflation expectations quickly reflect the future deceleration of inflation caused by a negative demand shock, greater price flexibility increases the real interest rate and magnifies the short-run output loss. However, the strength of this effect depends on a few critical parameter values, which are subject to much uncertainty. We pursue this issue in detail in the analysis that follows. For our benchmark parameter values, the debt deflation effect alone also causes important destabilizing effects, almost completely offsetting the traditional stabilizing channels of price flexibility. For parameter values within a reasonable range of our estimates, however, the impact of the debt deflation effect is substantially reduced. Nevertheless, the results presented here clearly support the unorthodox claim that added price flexibility can reduce macroeconomic stability.

These results have strong policy implications. For if a decline in aggregate demand causes deflation which further reduces the demand for goods and services, or only negligibly expands it, then the economy has no automatic tendency to return to full employment within a reasonable time period. In this case, expansionary monetary and fiscal policies may be necessary.

II. The Simulation Model

This section presents the model we use to estimate the aggregate effects of price flexibility in the contemporary U.S. economy. The model incorporates both stabilizing and potentially destabilizing effects of price flexibility. The parameters are taken from empirical research in the literature except where these estimates are unavailable. In these cases, we use our own estimates of the parameters. The specific point

---

[7] Calomiris and Hubbard (1985), DeLong and Summers (1986a), and Taylor (1986, 1987) analyze the historical statistical relationship between price flexibility and output stability in reduced-form models. Zarnowitz (1989) and Gray and Kandil (1991) point out that these correlations need not imply causation.

estimates are less important than the *range* of estimates. In the next section, we report simulation results across a wide range of parameter values to examine the robustness of our conclusions and to determine the key structural parameters on which the answer to the question, "Is price flexibility stabilizing?" depends.

The model's structure emphasizes demand-side effects that play the most important role in transmitting price flexibility into expenditure changes. The supply side of the system enters through a Phillips curve equation that causes the inflation rate to fall when real output is below its potential or "natural" level. The supply-side adjustment does not occur instantaneously, however. Persistence in the inflation rate could be explained, for example, by contract models along the lines of Fischer (1977) or Taylor (1979). The faster the supply side translates an output gap into lower inflation, the greater the system's price flexibility.

The aggregate consumption function follows the general form of the model used by Blinder and Deaton (1985), modified to incorporate the effect of variables that play a key role in the transmission of price changes to the real economy. The equation is specified as:

$$(1) \qquad C_t = A_0 + A_1 C_{t-1} + A_2(Y^D{}_t - A_1 Y^D{}_{t-1}) + A_3[R_t - E_{t-1}PI_t] + A_4(NOA_t / P_t) + A_5[(CIP_t / P_t) - A_1(CIP_{t-1} / P_{t-1})],$$

where C_t denotes real consumption and $Y^D{}_t$ is real disposable income. R_t is the nominal interest rate, $E_{t-1}\ PI$ is the expected inflation rate between the beginning of period t and the beginning of $t+1$ based on information known prior to period t.[8] Outside nominal assets are represented by NOA_t, P_t is the aggregate price level, and the nominal variable CIP_t represents consumers' interest payments obligations.

The lagged consumption term incorporates previous information relevant for current consumption (see Hall, 1978). From the wide variety of consumption functions they estimate, Blinder and Deaton (1985) find that the coefficient on lagged consumption (A_1) lies between 0.7 and 0.95.[9] In our benchmark simulation, we use a value of 0.8 for A_1.

---

[8] Some economists argue consumption spending should be a function of the after-tax real interest rate. If we were modify our specification to include taxes on nominal interest rates, the real interest rate effect would be strengthened, biasing the case toward the destabilizing effects of flexible prices.

[9] The A_1 coefficient range reported here is a transformation of Blinder and Deatons' lagged consumption coefficient to reconcile our level of consumption specification with the difference in logs used by Blinder and Deaton. The approximation error in using levels versus logs for this coefficient is less than 0.2 percent over our simulation horizon.

If consumers are liquidity constrained, consumption will vary with changes in current disposable income. As, Hall and Mishkin (1982) show, if some consumers spend all of their current income, the term $Y^D_t - A_1Y^D_{t-1}$ enters the consumption equation. The coefficient A_2 can be interpreted as the fraction of consumers that face binding liquidity constraints. By subtracting the term $A_1Y^D_{t-1}$, the dynamics that would otherwise arise from the autoregressive specification of consumption are offset, and the full effect of liquidity constraints on consumption is immediate. Our benchmark value for the parameter A_2, consistent with Hall and Mishkin (1982), Blinder and Deaton (1985) and others, is 0.2.

The real interest rate and real outside asset effects in the consumption equation are important channels through which price flexibility may affect the aggregate economy. If output is below its full employment level, inflation will fall relative to money growth and the growth of nominal outside assets. The resulting increase in the real money stock can stimulate consumption through Keynes and Pigou effects. Therefore, the parameters A_3 and A_4 of central interest for our study.

The effects of real interest rates on consumption are notoriously unstable, depending on the particular specification and the sample period (see the discussion in Blinder and Deaton, 1985). The standard errors of the estimates are often large, and some authors even find that higher interest rates stimulate consumption (income effects dominate substitution effects). Boskin (1978) estimates among the largest negative interest elasticities of consumption. His estimates imply that A_3 in the specification of equation (1) should take on a value of about -11. In some versions of their consumption function, Blinder and Deaton (1975) find effects of this size, but for nominal interest rates only, not the real rate of interest. Furthermore, their results are not robust across different sample periods. Because the negative interest elasticity of consumption may be an important stabilizing channel for price flexibility, we have used a value of -6 for A_3 in our benchmark simulation, about half the Boskin value, but still quite large in relation to most of the literature. The effect of changing this parameter, however, will be an important issue in the simulations that follow.

The effect of changes in the real value of outside assets on consumption (the real balance or Pigou effect) can be thought of as an annuity. Therefore, we set A_4 to give long-run results consistent with a (rather high) 5 percent real interest rate, that is $0.05 = A_4/(1-A_1)$. The high value assures that we will not understate the stabilizing influence of lower prices through this channel. Nominal outside assets include the monetary base plus government debt held by private domestic agents.[10]

The variable CIP_t/P_t (consumers' real interest payment commitments) captures the potential contraction in consumption that occurs when the real value of consumers' interest payments rises as the price level falls. Because this effect is immediate, we remove the dynamic impact of the autoregressive term in the consumption function by subtracting $A_1(CIP_{t-1}/P_{t-1})$ from the current value of real consumer interest payments.

This kind of effect has not been studied in the empirical consumption literature, although it is important for assessing the role played by price flexibility in offsetting or magnifying aggregate demand shocks. To establish a reasonable range for the parameter A_5, we rely on a liquidity constraint approach. Suppose that liquidity-constrained consumers have a real debt service capacity of DS, which could be related to their disposable income, financial wealth, etc. This debt service capacity will allow them to take on debt up to a level of $DS/(i+a)$ where i is the real interest rate and a is the amortization rate for loans to these consumers. Assume that these individuals are at a "corner solution" to their optimal consumption problem so they borrow up to their debt capacity. Then, a one dollar increase in the real value of existing consumer interest payment obligations (CIP/P) will reduce DS by a dollar, and debt and consumption for these individuals will fall by $1/(i+a)$. To establish a range for the value of A_5, therefore, we make assumptions about the fraction of consumers that face binding liquidity constraints, the real interest rate, and the amortization rate.[11]

Consistent with the discussion presented above about the effect of disposable income on consumption, we assume that between 15 and 25 percent of consumption is accounted for by individuals who face binding liquidity constraints.[12] Suppose the real interest rate varies between 3 and 5 percent. The remaining parameter

[10] Including government debt as an "outside" asset is controversial. We include it here, however, because this assumption increases the quantitative impact of the real balance effect, and therefore makes stabilizing price flexibility more likely. We impose strict "Ricardian equivalence" later in the paper.

[11] This approach assumes that consumer debt is quickly reduced when liquidity-constrained agents exceed their debt service capacity. The effect may be more gradual. Other factors, however, tend to cause our approach to understate the impact of debt deflation on consumption. For example, the level of debt service capacity itself might be reduced in a contraction, and consumption by agents who are not strictly liquidity constrained may also be affected.

[12] This fraction of liquidity-constrained consumers is based on estimates of the "excess sensitivity" of consumption to movements in disposable income. Using a more direct approach based on measuring liquid assets across consumer panel data, Zeldes (1989) finds that the fraction of liquidity constrained consumers may be much higher, perhaps exceeding 50 percent.

necessary to establish a range for A_5 is the proportion of consumer debt amortized per period. This fraction is undoubtedly very small for home mortgages. Amortization averages about 3 percent per year for a 30 year home mortgage. Auto loans have average amortization rates of 20 to 30 percent. Credit card debt has very low minimum amortization, but actual amortization is probably substantially higher than the minimum level. Given the preponderance of mortgage payments in consumers' debt service, the average amortization rate probably lies between 5 and 20 percent. Calibrating the model to our initial value for consumption, these estimates give a range for the parameter A_5 of -0.6 to -3.1. Our benchmark value is the midpoint of the range, -1.85, but we will consider the effects of varying this value on our simulation results.[13]

To carry out simulations with equation (1), the dynamic evolution of the independent variables must be specified. We assume disposable income is 71.6 percent of GNP, its 1989 value. Nominal outside assets grow at 4 percent a year in our simulations. Real assets, therefore, would be constant at the 4 percent steady-state inflation rate we will assume to prevail in our benchmark simulation. The model determines the other variables endogenously.

Consumer interest payment obligations evolve according to:

$$\text{(2)} \qquad \log CIP_t = D_0 + D_1 \log CIP_{t-1} + (1-D_1) \log P_{t-1} + D_2 \log Y^D_{t-1} + D_3 \log R_{t-1}.$$

This specification assumes that nominal interest payment commitments are determined a quarter in advance of payment. Innovations in these debt service commitments arise from changes in the price level, the nominal interest rate, and real income. We constrain the price parameter so that the long-run elasticity of interest payment obligations with respect to price changes is unity. Because we are aware of no empirical studies of the dynamics of consumer interest payments, we estimated the parameters of equation (2) using data from 1964 through 1987. We use the 3-month Treasury bill interest rate for R, the consumer price index for P, and the sum of consumer interest payments to businesses and implicit household mortgage payments from the Department of Commerce's National Income and Product Accounts to obtain CIP. Our estimates are based on annual data because quarterly data are not available for consumer mortgage payments. The estimated short-

[13] We have found that estimated values of A_5 from aggregate time-series data can generate larger effects than the range assumed here. These estimates, however, were not robust to changes of specification and sample period, and they may suffer from simultaneity problems. The empirical effect of debt and debt service on consumption probably needs to be analyzed with micro-level consumption data.

run value of the elasticity of *CIP* with respect to lagged prices is 0.184 with a standard error of 0.079. Because this coefficient estimate is substantially less than one, nominal debt service payments show persistence, adjusting slowly when the aggregate price level changes. Therefore, when prices fall, real cash commitments will rise, and the model generates a "debt deflation effect" in the consumption function. The estimated elasticity of cash commitments with respect to real disposable income is 0.432, with a standard error of 0.160. Nominal interest rates have a small estimated elasticity of -0.003, with a standard error of 0.027. Note that the theoretical sign on nominal interest rates is ambiguous: higher nominal rates increase debt service on new or variable interest rate loans, but they may also reduce borrowing.

We assume that inflation is determined by an augmented Phillips curve process,

(3) $$PI_t = PI_{t-1} + 100 \times H \times [(Y_{t-1} - Y^*) / Y^*],$$

where PI_t is the actual inflation rate between the beginning of period t and the beginning of period $t+1$ and Y^* is the "natural" output rate. The inflation rate is the quarterly consumer price index inflation rate. This is the key supply-side equation in the model, with the parameter H representing the degree of price flexibility.[14] In simulations of the model, once the initial price level is specified, equation (3) determines the evolution of the aggregate price level.

There is a large literature reporting empirical estimates of parameters such as H. Although there is much variation in the reported estimates, Summers (1984, p. 183) reports that "...a middle-of-the-road estimate is that it takes about five point years of GNP gap to reduce the inflation rate by 1 percent..." Accordingly, for our quarterly simulations we set the benchmark price flexibility parameter (H) equal to 0.05.[15] In our simulations, we consider the effect of increasing price flexibility well above this benchmark value.

The empirical strength of the real interest rate effect depends fundamentally on the specification of inflation expectation formation. We initially consider the case in which expectations are formed with perfect

---

[14] This definition of price flexibility is fairly common. Variants of it are used by both DeLong and Summers (1986b) and Caskey and Fazzari (1987). King (1988) discusses another concept of price flexibility: the proportion of wages set in continuously clearing spot markets as opposed to contract markets. King argues that the DeLong and Summers real interest rate effects are absent with this specification.

[15] Using quarterly data from 1974:1 through 1988:1, our own estimate of the parameter H in an equation that allowed for the effects of supply shocks is 0.05 with a standard error of 0.12.

foresight. That is, we assume that expectations are consistent with the process generating actual inflation from equation (3).[16]

To test the sensitivity of our results to the expectation formation process, we also study the effects of price flexibility with adaptive expectations:

$$(4) \qquad E_{t-1}PI_t = E_{t-2}PI_{t-1} + K(PI_{t-1} - E_{t-2}PI_{t-1}).$$

This kind of inflation expectation equation can be justified by learning models.[17] Equation (4) would be the optimal forecasting rule if inflation followed a first-order moving average process. Using quarterly consumer price index data from 1974:1 to 1988:2, we estimated K to be 0.58 with a standard error of 0.12 by fitting a MA 1 process to the quarterly CPI inflation data over this period.

Following Fazzari and Athey (1987), we specify the investment function as

$$(5) \qquad I_t = B_0 + B_1L_1[(Y_{t-1}/CK_{t-1}) - (Y_{t-2}/CK_{t-2})] + B_2L_2(IFIN_t) + B_3L_3(INTR_t).$$

The first bracketed term is a distributed lag of a variable proportional to the change in the desired capital stock based on a specification from Hall and Jorgenson (1968). The variable CK is the cost of capital, the real interest rate plus the geometric depreciation rate. The sum of the coefficients on four years of lags of this variable, from Fazzari and Athey (1987), is 3.6.[18] The distributed lags of *IFIN* and *INTR* represent the debt deflation effects of real internal finance and real interest expense. Their estimated effect, spread over three-year distributed lags, sum to 0.38 and -0.80, respectively. In the simulations, real internal finance is assumed to

---

[16] The simple form of the actual inflation equation (3) allows model-consistent expectations to be specified in a straightforward way. DeLong and Summers use an inflation equation based on Taylor (1979) that necessitates a complex numerical algorithm to determine model-consistent expectations. Our simple approach in equation (3) captures the same kind of inflation persistence one gets from the Taylor specification, and the solution for model-consistent expectations is trivial. The structural interpretation of equation (3), however, is not as clear as in the Taylor model.

[17] See, for example, Friedman (1979) and Caskey (1985).

[18] The Fazzari and Athey specification is estimated from an extensive micro data set. The estimates are also consistent with an aggregate time-series study based on a similar specification reported in Fazzari (1987). The expression for the desired capital stock is based on a Cobb-Douglas specification of firm technology. We also considered a CES specification in the simulations with the elasticity of substitution varying from zero to the Cobb-Douglas case of unity.

be a constant fraction of GNP.[19] Simulated real interest expense is determined dynamically from a nominal interest payment commitment equation for firms (*FIP*) similar to the consumer interest payment obligation equation presented earlier:

(6) $INTR_t = FIP_t / P_t$

(7) $\log FIP_t = F_0 + F_1 \log FIP_{t-1} + (1-F_1) \log P_{t-1} + F_2 \log Y_{t-1} + F_3 \log R_{t-1}.$

The *FIP* variable is total nominal interest payments by firms. To maintain long-run neutrality, we constrain the price parameter so that the long-run elasticity of firms' interest payments with respect to price changes is unity. Again, since we are unaware of any empirical studies of the dynamics of firm interest payments and only annual interest payments of nonfinancial corporate businesses are reported in the National Income and Product Accounts, we estimated coefficients for equation (7) using annual data from 1964 through 1987. Our estimates used in the benchmark simulation are 0.323 with a standard error of 0.153 for lagged *FIP*, 0.677 with the same standard error for prices, 1.79 with a standard error of 0.427 for real GNP, and 0.155 with a standard error of 0.071 for the nominal 3 month Treasury bill interest rate.

The current values of the nominal interest rate and real GNP are determined endogenously. The simulations use the following linear reduced-form interest rate equation:

(8) $R_t = G_0 + G_1(M1_t/P_t) + G_2 Y_t + G_3 E_{t-1}PI_t,$

where R is the 3-month treasury bill interest rate. This form provides some benefits for the simulations. Because we examine short-run fluctuations following small demand shocks, the linear form gives a first-order approximation to any functional specification. Also, equation (8) includes the "Fisher effect" of expected inflation rates on nominal interest rates in a straight-forward way. This is a key issue here, for if nominal rates fall quickly as inflation expectations decline, the real interest rate effect will not be as strong.

We draw our benchmark values for the parameters in the interest rate equation from mainstream estimates in the literature. As indicated in Judd and Scadding (1982), the vast literature reporting estimated money demand equations implies a wide range of values for the elasticity of interest rates with respect to changes in real M1. For example, Clarida and Friedman's (1983) estimates indicate that a 1 percent increase in

---

[19] This assumption may cause us to understate the instability induced by cash flow variations on investment because profits are more variable than GNP. For an extensive study of the effects of cash flow on investment see Fazzari, Hubbard and Petersen (1988).

real M1 will result in a 0.95 percent decrease in the three-month Treasury bill interest rate. Goldfeld's (1976) money demand study implies an elasticity estimate of -3.95 percent for interest rates with respect to real M1. Recent studies by Poole (1988) and Hoffman and Rasche (1989) suggest interest rates are not very elastic with respect to changes in the money stock, which is more in line with the Clarida and Friedman finding. A large "liquidity effect" of money on interest rates is likely to make price flexibility more stabilizing, because as lower prices increase the real supply of money, interest rates fall more and have a greater stimulative impact on expenditure. Thus, to assure that our simulation results do not understate the importance of this stabilizing channel for price flexibility, we set the benchmark coefficient on real M1 to equal -0.0362, consistent with Goldfeld's elasticity estimates. Since the parameter G_1 is key and there is uncertainty regarding its value, we test the sensitivity of the simulation results to variations from our benchmark value.

Previous estimates of the effect of changes in real GNP on interest rates have also varied. Clarida and Friedman's (1983) estimates indicate that a 1 percent increase in real GNP will result in a 2.2 percent increase in the interest rate. Goldfeld (1976) estimates the elasticity of interest rates with respect to real GNP to be 2.5. Research by Poole (1988) and Hoffman and Rasche (1989) would suggest an elasticity of interest rates with respect to real GNP of somewhat less than 2. We set the benchmark coefficient on real GNP at 0.0038 to agree with the Goldfeld's elasticity estimate and consider the effect of changing this parameter on the simulation results.

There have been numerous studies of the effect of changes in inflation expectations on nominal interest rates, with most implying that a one point increase in expected inflation will lead to a 0.7 to 1.2 point increase in nominal interest rates. Authors have explained estimates above 1.0 as the consequence of non-neutral tax laws. A sample of the recent literature yields the following estimates for G_3: Wilcox (1983) estimates $0.76 < G_3 < 1.1$, VanderHoff (1984) estimates G_3 equals 1.09, Tanzi (1985) estimates $0.89 < G_3 < 1.26$, and Peek and Wilcox (1987) find $0.69 < G_3 < 0.84$. In our benchmark simulations, we set G_3 equal to 0.8, a value consistent with the findings in the literature.

This completes the specification of the model. The benchmark simulation equations are summarized in Table 1. The constant terms are set to equate the initial values to actual 1989 data. We emphasize that the objective of this paper is not to present original estimates of these macro-structural relationships. Rather, these equations provide a benchmark for dynamic simulation parameters. The robustness of the simulation results to substantial changes in the estimated parameters is discussed extensively in the next section.

Table 1

Benchmark Simulation Equations

(1') $C_t = A_0 + 0.80\, C_{t-1} + 0.20\, (Y^D_t - 0.80 Y^D_{t-1}) - 6.0\, [R_t - E_{t-1}PI_t] + 0.001\, (NOA_t/P_t)$
$- 1.85[(CIP_t/P_t) - 0.80(CIP_{t-1}/P_{t-1})]$

(2') $\log CIP_t = D_0 + 0.816 \log CIP_{t-1} + 0.184 \log P_{t-1} + 0.432 \log Y^D_{t-1} - 0.003 \log R_{t-1}$

(3') $PI_t = PI_{t-1} + 0.05\, [(Y_{t-1} - Y^*) / Y^*]$

For the perfect foresight expectation formation model:

(4a') $E_{t-1}PI_t = PI_t$

For the adaptive expectation model:

(4b') $E_{t-1}PI_t = E_{t-2}PI_{t-1} + 0.58(PI_{t-1} - E_{t-2}PI_{t-1})$

(5') $I_t = B_0 + 3.6\, L_1[(Y_{t-1} / CK_{t-1}) - (Y_{t-2} / CK_{t-2})] + 0.38\, L_2(IFIN_t) - 0.80\, L_3(INTR_t)$.

(6') $INTR_t = FIP_t / P_t$

(7') $\log FIP_t = F_0 + 0.323 \log FIP_{t-1} + 0.677 \log P_{t-1} + 1.790 \log Y_{t-1} + 0.155 \log R_{t-1}$.

(8') $R_t = G_0 - 0.0362\, (M1_t / P_t) + 0.0038\, Y_t + 0.8\, E_{t-1}PI_t$.

(9') $Y_t = C_t + I_t +$ Exogenous Autonomous Expenditure

III. Simulation Results

In this section, we report simulation results to analyze the short-run effect of price flexibility on output stability. We also extensively analyze the robustness of the model's qualitative predictions regarding price flexibility. The model is not designed, however, to address long-run growth in the capital stock or labor force. Also, the simulations do not incorporate endogenous policy responses. In particular, monetary policy follows a fixed growth rule over the simulation horizon.

In all the cases analyzed here, the economy is initially in equilibrium at the "natural" output level with the variables set to correspond to actual 1989 values for the U.S. Real variables are expressed in 1982 prices. The money supply and all nominal variables initially grow at a steady-state, 4 percent annual rate. In the initial simulation quarter, government spending is permanently reduced by 1 percent of real GNP. The simulation tracks the dynamic effect of this shock for the following 10 quarters. The tables below present the cumulative output loss relative to potential GNP over the simulation horizon, expressed as the percentage change relative to the output loss with zero price flexibility (The parameter H in equation (3) equals zero). We report the percentage change in output statistic for the benchmark value of the price flexibility parameter (H = 0.05) and a case with H set at three times this estimated value. In the tables, negative values for the percentage change indicate that price flexibility stabilizes real output; positive values indicate that price flexibility is destabilizing.

The specification of inflation expectation formation has a significant impact on the results. We present results from three different models: (1) "slow" adaptive expectations (with the adjustment parameter K in equation (4b) equal to 0.20), (2) "fast" adaptive expectations (with K equal to its estimated value of 0.58), and (3) perfect foresight (rational) inflation expectations.

A. The Simulated Effects of Price Flexibility

Theoretically, price flexibility can be stabilizing or destabilizing, depending on the empirical parameter values in the model. We begin our analysis by simulating the dynamic response of our benchmark model following the negative government spending shock. Table 2 presents the percentage output loss over 10 quarters for different price flexibility parameters. The estimated value of the price flexibility parameter is 0.05.

Table 2

Percentage Change Output Loss
(Relative to Zero Price Flexibility)
Benchmark Case

Price Flexibility Parameter	Slow Adaptive Expectations	Fast Adaptive Expectations	Perfect Foresight Expectations
0.05	0.42	0.95	1.47
0.15	1.37	2.73	4.42

With all three models of price expectation formation, the cumulative output loss would be smaller if there were *no price flexibility at all.* Tripling the amount of price flexibility relative to the estimated value increases output losses further. This striking result runs counter to conventional wisdom. It arises from a combination of the real interest rate effect and the debt deflation effect discussed in previous sections. These effects more than offset the standard stabilizing channels of lower prices.

Before analyzing these results in detail, it is important to demonstrate that the model can indeed generate stabilizing price flexibility for some parameter values. Suppose that the debt deflation effects in the consumption and investment functions are set to zero.[20] Furthermore, let the coefficient on inflation expectations in the nominal interest rate equation (8) be unity so that any reductions in expected inflation are immediately translated, point for point, into lower real interest rates, preventing the real interest rate effect from operating. Then, there can be no destabilizing influences of price flexibility. If the same shock is simulated under these conditions, with all other parameters at their benchmark values, the changes in output loss relative to the zero price flexibility case for all expectation models are -1.45 percent and -4.36 percent for price flexibility parameters of 0.05 and 0.15, respectively. These results show that price flexibility would be stabilizing in the model, if the destabilizing channels are empirically insignificant. We shall now examine these issues more carefully.

---

[20] The key cash flow parameters are the sensitivity of consumption and investment to real interest payments (A_5 and B_3 in equations 1 and 5). One could also interpret the impact of current disposable income on consumption (A_2) and the sensitivity of investment to cash flow (B_2) in this light, but changes in these parameters have no effect on the qualitative role played by price flexibility, they only affect the model's multipliers.

B. The Real Interest Rate and Price Flexibility

All three inflation expectation models result in destabilizing price flexibility in our benchmark simulation. Faster price adjustment, however, is *more* destabilizing when inflation expectations respond more quickly to changes in actual prices. With the slow adaptive expectations model, the output loss rises by 1.37 percent as the price flexibility parameter increases from 0 to 0.15. The corresponding figures for the fast adaptive expectations model and the perfect foresight model are 7.73 percent and 4.42 percent, respectively.

Closer examination of the simulation results clearly shows that the major factor explaining the different results across these specifications is the real interest rate effect. Table 3 gives the nominal interest rates, the actual and expected inflation rates, and the anticipated real interest rates from the simulations with a 0.15 price flexibility parameter, the case in which the differences across the models is greatest. In the perfect foresight case, nominal interest rates fall more quickly than in the adaptive case, as one would expect because the output path with perfect foresight expectations is below output with adaptive expectations. The quick deceleration of perfect foresight inflation expectations, however, dominates the fall in the nominal interest rate. The real interest rate is higher with perfect foresight expectations, depressing aggregate demand relative to the adaptive expectations case.

Table 3

Simulated Path of Interest Rates and Inflation Expectations

	Perfect Foresight Expectations				Slow Adaptive Expectations			
Quarter	Nom. Interest Rate	Actual Infl.	Exp. Infl.	Real Interest Rate	Nom. Interest Rate	Actual Infl.	Exp. Infl.	Real Interest Rate
1	7.32	4.00	4.00	3.32	7.32	4.00	4.00	3.32
2	7.19	3.82	3.82	3.37	7.33	3.82	4.00	3.34
3	7.05	3.65	3.65	3.41	7.31	3.65	3.96	3.34
4	6.91	3.49	3.49	3.42	7.25	3.49	3.90	3.35
5	6.77	3.39	3.39	3.43	7.16	3.34	3.82	3.34
6	6.62	3.19	3.19	3.43	7.05	3.20	3.72	3.33
7	6.46	3.05	3.05	3.41	6.93	3.06	3.62	3.31
8	6.30	2.91	2.91	3.39	6.29	2.93	3.51	3.68
9	6.13	2.77	2.77	3.36	6.64	2.80	3.39	3.25
10	5.96	2.64	2.64	3.33	6.48	2.68	3.27	3.21

It would be wrong, however, to attribute this difference in results to perfect foresight versus adaptive expectations. Rather, it is simply the speed with which inflation expectations fall after a demand shock that determines the magnitude of the real interest rate effect. This point is illustrated by the simulation results with "fast" adaptive inflation expectations presented in Table 2. The increased output loss in this simulation compared to the slow adaptive expectations model is also due to the real interest rate effect.

To separate the impact of the real interest rate effect from the debt deflation effect, Table 4 presents simulations with the cash flow parameters set to zero:

Table 4

Percentage Change in Output Loss
(Relative to Zero Price Flexibility)
Debt Deflation Effects Set to Zero

Price Flexibility Parameter	Slow Adaptive Expectations	Fast Adaptive Expectations	Perfect Foresight Expectations
0.05	-0.68	-0.09	0.33
0.15	-2.22	-0.26	2.22

In the absence of the debt deflation effect, the real interest rate effect is not strong enough to overcome the standard stabilizing channels for price flexibility of the two adaptive expectations models. Although, even with the slow adaptive expectation model, the real interest rate effect alone eliminates about half the output gains from price flexibility that arises from the simulation with no destabilizing effects at all. With perfect foresight expectations, the real interest rate effect alone causes destabilizing price flexibility.

Furthermore, the specification of our interest rate equation is even less likely to generate destabilizing price flexibility than the model used by DeLong and Summers (1986b), or any dynamic IS/LM model with a conventional money demand function. This is because our reduced-form interest rate equation includes a direct "Fisher effect" of expected inflation on nominal interest rates. With our benchmark parameters, a one percentage point reduction in expected inflation causes a 0.8 percentage point reduction in the nominal interest rate. In models that specify financial equilibrium through money demand and supply, the effect of expected inflation on nominal interest rates is indirect, working through shifts in the IS curve. We can study the predictions of this kind of model by setting the expected inflation parameter in the interest rate equation (G_3) to zero. The results appear in table 5; the debt deflation effects are also set to zero in this simulation to isolate the real interest rate effect.

Table 5

Percentage Change in Output Loss
(Relative to Zero Price Flexibility Case)
Inflation Effect On Nominal Interest Rates Set to Zero
(Debt deflation effects Also Set to Zero)

Price Flexibility Parameter	Slow Adaptive Expectations	Fast Adaptive Expectations	Perfect Foresight Expectations
0.05	2.22	5.47	9.91
0.15	6.58	16.85	31.94

In all models, especially the perfect foresight model analogous to that used by DeLong and Summers (1986b), additional price flexibility is strongly destabilizing, even in the absence of debt deflation effects.

C. Debt Deflation Effects

To analyze the contribution of the debt deflation effects separately from the real interest rate effect we set the coefficient on expected inflation in the interest rate equation to unity. As mentioned above, this assumption guarantees that reductions in expected inflation will not increase real interest rates so the real interest rate effect does not operate. These results appear in Table 6.

Table 6

Percentage Change in Output Loss
(Relative to Zero Price Flexibility Case)
Inflation Effect on Nominal Interest Rates Set to 1

Price Flexibility Parameter	Slow Adaptive Expectations	Fast Adaptive Expectations	Perfect Foresight Expectations
0.05	-0.32	-0.53	-0.34
0.15	-1.05	-1.68	-2.63

At our benchmark parameter values, the estimated debt deflation effects are not strong enough on their own to make price flexibility destabilizing. The debt deflation effects alone, however, offset 40 to 75 percent of the standard stabilizing influence, depending on the price expectations model.[21]

The consumer cash commitment coefficient (A_5 in equation 1) in the consumption function has a greater impact on the results than the corresponding coefficient in the investment equation (B_3). The benchmark value of A_5 is -1.85 but it is the midpoint of a rather large range of plausible estimates. If A_5 is reduced in absolute value, the debt deflation effect on consumption becomes weaker and price flexibility becomes more stabilizing. If A_5 is set at -2.7, well within the reasonable range for A_5 (-0.6 to -3.1) identified above, then the debt deflation effects alone are strong enough make additional price flexibility destabilizing for all the expectations models. Thus, the debt deflation effect plays an important role in the system's dynamics.

D. Robustness of Results

The results presented to this point suggest that destabilizing price flexibility may be a realistic characteristic of the U.S. economy. The point estimates used in our benchmark simulations, however, are subject to error. Therefore, we analyzed the robustness of the qualitative results concerning price flexibility across a wide range of alternative parameter values.

---

[21] The results across price expectation models would be identical if the elasticity of household and firm cash commitments (CIP and FIP) with respect to the nominal interest rate were zero.

Probably the most significant changes in the results occurred when we changed the parameters in the interest rate equation. The key issue is the "liquidity effect," the extent to which changes in real money balances reduces nominal interest rates. As mentioned above, the greater the liquidity effect, the larger the fall in nominal interest rates when lower inflation increases real balances. Therefore, a smaller liquidity effect should reduce the stabilizing impact of price flexibility.

The simulations reported in Table 7 confirm this prediction. Our estimated benchmark coefficient on real balances in the interest rate equation (G_1), derived from Goldfeld (1976), gives a rather large liquidity effect relative to other estimates found in the literature. The results in Table 7 were generated using a value of G_1 consistent with the money demand study of Clarida and Friedman (1983). This value is about one fifth the size of the Goldfeld estimate and is consistent with many of the estimates in the literature that show relatively small liquidity effects.

Table 7

Percentage Change in Output Loss
(Relative to the Zero Price Flexibility Case)
Liquidity Effect on Nominal Interest Rates Reduced
to One Fifth of its Benchmark Value

Price Flexibility Parameter	Slow Adaptive Expectations	Fast Adaptive Expectations	Perfect Foresight Expectations
0.05	1.58	2.10	2.63
0.15	4.84	6.31	7.99

In this case, the simulated percentage output loss with slow adaptive expectations rises by 4.84 percent as the price flexibility parameter increases from 0 to 0.15. In the benchmark simulation, the increase was only 1.37 percent (see Table 2). The results for the other expectation models are similar. Not surprisingly, the effect of increasing the sensitivity of interest rates to changes in real money balances makes price flexibility more stabilizing. To obtain stabilizing price flexibility in the model with our estimated (fast) adaptive expectation formation, we need almost to double the absolute value of the liquidity effect relative to the already large effect derived from Goldfeld's estimates.[22]

Changes in the consumption function parameters also lead to important insights regarding the qualitative impact of price flexibility. One of the more interesting changes involves sensitivity of consumption to the after-tax, real interest rate (A_4). Our benchmark value of A_4 is large in absolute value compared with much of the literature. Many authors find smaller effects, or even effects with the opposite sign. The results in Table 8 are based on an A_4 coefficient one half the size of the benchmark value, still a sizable effect.

Table 8

Percentage Change in Output Loss
(Relative to Zero Price Flexibility Case)
Sensitivity of Consumption to Real Interest Rates
Reduced by One Half

Price Flexibility Parameter	Slow Adaptive Expectations	Fast Adaptive Expectations	Perfect Foresight Expectations
0.05	0.81	1.02	1.22
0.15	2.34	2.94	3.45

In this experiment, additional price flexibility is still destabilizing for all our inflation expectation models. But price flexibility is more destabilizing than in the benchmark case (Table 2) for slow adaptive expectations and less destabilizing for perfect foresight expectations.

The real interest rate effect explains these findings. This effect causes real interest rates to rise if expected prices fall quickly. Therefore, the lower the sensitivity of expenditure to real interest rates, the less destabilizing additional price flexibility will be when the real interest rate effect is dominant, as in the perfect foresight case. With slow adaptive expectations, however, real interest rates fall, and a reduced sensitivity of consumption to real interest rates reduces the stabilizing impact of the "Keynes effect." In this case, the debt deflation effect becomes the dominant factor, and price flexibility is destabilizing. In fact, with the lower

[22] Changes in the sensitivity of interest rates to fluctuations in real GNP had a small effect on the model's multipliers and the quantitative results, but the qualitative conclusions concerning price flexibility remained the same as in the benchmark case. We discussed the effect of varying the sensitivity of interest rates to expected inflation earlier.

interest sensitivity of consumption used for Table 8, the debt deflation effect itself is destabilizing even when the real interest rate effect is inoperative. This experiment shows how subtle the impact of price flexibility on macroeconomic stability can be.

In our benchmark simulations, we assumed that government debt constitutes part of net outside nominal wealth. This assumption increases the quantitative impact of the "Pigou effect." But it is controversial; under "Ricardian equivalence," agents perceive government debt as a future tax liability and changes in the real value of government debt will not affect consumption. Table 9 presents simulation results in which the Pigou effect applies to the monetary base only, government debt is excluded.

Table 9

Percentage Change in Output Loss
(Relative to Zero Price Flexibility Case)
Model with "Ricardian Equivalence"

Price Flexibility Parameter	Slow Adaptive Expectations	Fast Adaptive Expectations	Perfect Foresight Expectations
0.05	0.53	1.05	1.58
0.15	1.68	3.15	4.73

These figures are close to the benchmark case. This result occurs in spite of the fact that removing government debt from the nominal outside assets variable reduces the base for the Pigou effect by a factor of about seven and that the Pigou effect coefficient is set rather high. These findings suggest that the Pigou effect is not a very important empirical channel through which price flexibility affects macro stability.[23]

The changes in the simulations from varying the parameters of the investment function are largely parallel to the results already discussed for the consumption function. Changes in the investment parameters affect the quantitative results, but the degree to which price flexibility is stabilizing or destabilizing remains quite robust across a wide range of parameters for the investment equation.

---

[23] Changes in the other parameter of the consumption function affected the system's multipliers, but the qualitative results for price flexibility remained virtually unchanged for variations in the disposable income parameter (A_2) from 0 to 0.4, and changes in the coefficient on lagged consumption (A_1) from 0.7 to 1.0.

III. Conclusions

At least since the study by Modigliani (1944), the result that greater price flexibility stabilizes aggregate output fluctuations has been a central premise of macroeconomic theory. In spite of its theoretical prominence, however, this result has not been subject to much empirical scrutiny. The relative empirical neglect of such an important aspect of theory may be due in part to the fact that the effect of price flexibility on the economy's dynamics cannot be tested through the estimation of a single static equation; the question is fundamentally dynamic and it depends in complicated ways on the interaction of many behavioral relations.

We have taken a step toward the empirical assessment of the role of price flexibility in promoting aggregate output stability. Our approach allows us to identify the key behavioral parameters and specifications that determine the dynamic effect of price flexibility. This insight, however, does not come without cost. The model has a simple form, and we must rely on parameter values that are difficult to estimate precisely. Thus, the results from any particular simulation should not be emphasized; interesting conclusions emerge from analyzing the price flexibility issue across a wide range of parameters.

Most of our results imply that in the U.S. economy the empirical strength of the destabilizing aspects of price flexibility, the real interest rate and debt deflation effects, more than offsets the conventional stabilizing effects.[24] We certainly cannot rule out the possibility, however, that price flexibility could be stabilizing, as it is in our model for some parameter values within a reasonable range of our simulation benchmarks. Further research is needed to pin down the key behavioral and institutional parameters and to examine a broader range of specifications.

Our results clearly identify, however, the parameters on which the central questions turn. The speed with which agents adjust inflation expectations downward, and real interest rates upward, following a fall in

---

[24] These results apply to the response of the system after negative demand shocks. Our model does not address the dynamic adjustment of the system following supply shocks. King (1988) argues that the real interest rate effect in DeLong and Summers (1986b) may cause price flexibility to be more stabilizing after a supply shock. We do not pursue this issue here except to note that even if the qualitative effects of price flexibility following a supply shock do not conflict with standard theory, the results we obtain for aggregate demand fluctuations still lead to an important qualification to conventional wisdom.

output is of central importance. The sensitivity of interest rates to changes in real money balances (the liquidity effect) also plays a central role in determining the qualitative effect of price flexibility on macro stability.

We also show that nominal rigidities in debt payment commitments can cause empirically important destabilizing effects from increases in price flexibility. This channel is somewhat more difficult to analyze than the real interest rate effect and the results are less precise because the relevant behavioral parameters have not been thoroughly studied in the literature.

In spite of some of the ambiguities, however, the findings presented here show that the possibility of destabilizing price flexibility not just a theoretical curiosity, nor is it a relic of the Great Depression. It may be a characteristic of today's U.S. economy. More empirical and theoretical research is needed on this topic to provide more definite answers to the questions raised here. If, in fact, a more rapid fall in wages and prices in a demand-induced recession would further depress aggregate demand, or only negligibly expand it, a fundamental revision of the way economists think about macroeconomic adjustment is necessary.

REFERENCES

Bernanke, Ben. "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression," *American Economic Review*, Vol. 73, No. 3, (June 1983), pp. 257-276.

Bernanke, Ben and John Campbell. "Is There a Corporate Debt Crisis?" *Brookings Papers on Economic Activity*, 2:1988, pp. 83-140.

Blinder, Alan and Angus Deaton. "The Time Series Consumption Function Revisited," *Brookings Papers on Economic Activity*, 1985:2, pp. 465-511.

Boskin, Michael. "Taxation, Saving and the Rate of Interest," *Journal of Political Economy*, Vol. 86, No. 2, Part 2 (1978), pp. 3-28.

Caskey, John. "Modeling the Formation of Price Expectations: A Bayesian Approach," *American Economic Review*, Vol. 75, No. 4 (September 1985), pp. 768-76

Caskey, John and Steven Fazzari. "Nominal Debt Commitments and Aggregate Demand: Is Wage Flexibility Stabilizing," *Economic Inquiry*, Vol. 25, No. 24, (October 1987), pp. 583-597.

Calomiris, Charles and R. Glenn Hubbard. "Price Flexibility, Credit Rationing and Economic Fluctuations: Evidence From the U.S., 1879-1914," NBER Working Paper #1767, November, 1985.

Chadha, Binky. "Is Increased Price Flexibility Stabilizing?" *Journal of Money, Credit, and Banking*, Vol. 21, (November 1989), pp.481-97.

Clarida, Richard and Benjamin Friedman. "Why Have Short-Term Interest Rates Been So High?" *Brookings Papers on Economic Activity*, 2:1983, pp. 553-578.

Davidson, Paul. *Money and the Real World*, (New York: John Wiley and Sons) 1972.

DeLong, J. Bradford and Lawrence Summers. "The Changing Cyclical Variability of Economic Activity in the United States," in Robert J. Gordon (ed.) *The American Business Cycles: Continuity and Change*, (Chicago: University of Chicago Press) 1986a.

______________________. "Is Increased Price Flexibility Stabilizing?" *American Economic Review*, Vol. 26, No. 5 (December 1986b), pp. 1031-1044.

Driskill, Robert and Steven Sheffrin. "Is Price Flexibility Destabilizing?" *American Economic Review*, Vol. 76, No. 4 (September 1986), pp. 802-807.

Fazzari, Steven. "Tax Reform and Investment: How Big An Impact?" Federal Reserve Bank of St. Louis *Review*, Vol. 69, No. 1 (January 1987), pp. 15-27.

Fazzari, Steven and Michael Athey. "Asymmetric Information, Financing Constraints and Investment," *Review of Economics and Statistics*, Vol. 69, No. 3 (August 1987), pp. 481-487.

Fazzari, Steven, Bruce Petersen and R. Glenn Hubbard. "Financial Constraints and Corporate Investment," *Brookings Papers on Economic Activity*, 2:1988, pp. 141-206.

Fischer, Stanley. "Long-Term Contracts, Rational Expectations, and the Optimal Money Supply Rule," *Journal of Political Economy,* Vol. 85, No. 1 (April 1977), pp. 191-205.

Fisher, Irving. "The Debt-Deflation Theory of Great Depressions," *Econometrica,* Vol. 1, No. 5 (October 1933), pp. 337-357.

Flemming, J.S. "Wage Flexibility and Employment Stability," *Oxford Economic Papers*, Vol. 39, 1989, pp. 161-174.

Friedman, Benjamin. "Optimal Expectations and the Extreme Information Assumptions of 'Rational Expectations' Macromodels," *Journal of Monetary Economics*, Vol. 5, No. 1 (January 1979), pp. 23-41.

__________. "Increasing Indebtedness and Financial Stability in the United States," Mimeograph, Harvard University, September, 1986.

Goldfeld, Stephen M. "The Case of the Missing Money," *Brookings Papers on Economic Activity*, 3:1976, pp. 683-730.

Gray, Jo Anna and Magda Kandil. "Is Price Flexibility Stabilizing? A Broader Perspective," *Journal of Money, Credit, and Banking,* Vol. 23, No. 1 (February 1991), pp. 1-12.

Hall, Robert. "Stochastic Implications of the Life Cycle - Permanent Income Hypothesis: Theory and Evidence," *Journal of Political Economy,* Vol. 86, No. 6 (1978), pp. 971-987.

Hall, Robert and Fredric Mishkin. "The Sensitivity of Consumption to Transitory Income: Estimates from Panel Data on Households," *Econometrica*, Vol. 50, No. 2 (March 1982), pp. 461-481.

Hoffman, Dennis and Robert Rasche. "Long-Run Income and Interest Elasticities of Money Demand in the United States," NBER Working Paper No. 2949, April 1989.

Howitt, Peter. "Wage Flexibility and Full Employment," *Eastern Economic Journal,* Vol. 12, No. 3 (July-September 1986), pp. 237-242.

Hahn, Frank and Robert Solow. "Is Wage Flexibility a Good Thing?" in W. Beckerman (ed.) *Wage Rigidity and Unemployment,* (London: Gerald Duckworth and Co.) 1986.

Judd, John and John Scadding. "The Search for a Stable Money Demand Function: A Survey of the Post-1973 Literature," *Journal of Economic Literature*, Vol. 20, No. 3 (September 1982), pp. 993-1023.

King, Stephen. "Is Increased Price Flexibility Stabilizing?: Comment," *American Economic Review,* Vol. 78, No. 1 (March 1988), pp. 267-272.

Keynes, John Maynard. *The General Theory of Employment, Interest, and Money,* (London: First Harbinger Edition, 1964) 1936.

Minsky, Hyman. *John Maynard Keynes,* (New York: Columbia University Press) 1975.

Mishkin, Fredric. "Illiquidity, Consumer Durable Expenditure, and Monetary Policy," *American Economic Review,* Vol. 64, No. 4, (September 1976) pp. 642-653.

________. "The Household Balance Sheet and the Great Depression," *Journal of Economic History,* Vol. 38, No. 4, (December 1978), pp. 918-937.

Modigliani, Franco. "Liquidity Preference and the Theory of Interest and Money," *Econometrica,* Vol. 12, No. 1 (January, 1944), pp. 45-88.

Patinkin, Don. "Price Flexibility and Full Employment," *American Economic Review,* Vol. 38 (September 1948), pp. 543-564.

Peek, Joe and James Wilcox. "Monetary Policy Regimes and the Reduced Form for Interest Rates," *Journal of Money, Credit and Banking,* Vol. 19, No. 3 (August 1987), pp. 273-291.

Poole, William. "Monetary Policy Lessons of Recent Inflation and Disinflation," *The Journal of Economic Perspectives*, Vol. 2, Summer 1988, pp. 73-100.

Summers, Lawrence H. "The Long-term Effects of Current Macroeconomic Policies," in C. Hulten and I. Sawhill (eds.) *The Legacy of Reaganomics: Prospects for Longterm Growth*, (Washington, D.C.: Urban Institute Press) 1984.

Tanzi, Vito. "Fiscal Deficits and Interest Rates in the United States: An Empirical Analysis, 1960-84," *IMF Staff Papers*, Vol. 32, No. 4 (December 1985), pp. 551-576.

Taylor, John. "Staggered Wage Setting in a Macro Model," *American Economic Review,* Vol. 69, No. 2 (May 1979), pp. 108-113.

_______. "Improvements in Macroeconomic Stability: The Role of Wages and Prices," NBER Working Paper #1491, November 1986.

_______. "Differences in Economic Fluctuations in Japan and the U.S.: The Role of Nominal Rigidities," Mimeograph, October, 1987.

Tobin, James. "Keynesian Models of Recession and Depression," *American Economic Review,* Vol. 65, No. 2 (May 1975), pp. 185-202.

VanderHoff, James. "Evidence on the Varying Effect of Expected Inflation on Interest Rates," *The Review of Economics and Statistics*, Vol. 66, No. 3 (August 1984), pp. 477-481.

Wilcox, James. "Why Real Interest Rates Were So Low in the 1970's," *American Economic Review*, Vol. 73, No. 1 (March 1983), pp. 44-53.

Zarnowitz, Victor. "Cost and Price Movements in Business Cycle Theories and Experience: Causes and Effects of Observed Changes," NBER Working Paper No. 3132, October 1989.

Zeldes, Steven. "Consumption and Liquidity Constraints: An Empirical Investigation," *Journal of Political Economy*, Vol. 97, No. 2 (1989), pp. 305-346.