Accommodation, Supply Shocks, and Real Wage Resistance

by

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Introduction:

Perhaps the most important and hotly debated policy issue to emerge during the 1970's concerned the appropriate response of the monetary authorities to supply shocks. Should the policy authorities increase the money supply in the face of an adverse supply shock in the hope of stabilizing output at the expense of some additional inflation? Or was such a policy misguided not only because of the additional inflation but because it would fail to stabilize output?

Barro (1976) and others have argued in the context of flexible-price rational expectations models that any predictable monetary response towards supply disturbances will simply become embodied in the aggregate price level and have no effect on real output. In fact, attempts to accommodate shocks may simply add monetary noise to the system and slow the adjustment process. By now it is well known that the rational expectations hypothesis by itself does not imply these conclusions—they are particular to the information and market clearing assumptions of the model. Other economists have studied rational expectation models in which the monetary authorities face real policy options in the face of supply shocks.¹

Monetary policy can potentially be effective if either the monetary authorities can react faster than the private sector or anticipated monetary policy matters. The early empirical work of Barro (1977) and Barro and Rush (1980) indicated that anticipated monetary policy did not affect output but the more recent work by Mishkin (1982), Makin (1982), and Gordon (1982) does find a link from either anticipated money growth or anticipated growth in nominal GNP to output. According to these later studies, monetary policy can
influence output but because of the nature of reduced form studies, they are silent as to the mechanisms or channels of monetary policy.

In the nominal contract based models of Fischer (1977) and Taylor (1980), monetary policy can influence the probability of distribution of output and trade-offs exist between output and price variability. Policies that accommodate supply disturbances can reduce the variance of output but only at the expense of an increase in the variance of prices. Does this general principle - accommodation reducing the variance of output but increasing the variance of prices - carry over to other plausible non-Walrasian rational expectation models? If it does, the monetary authorities can at least have qualitative knowledge concerning the likely effects of alternative policies towards supply shocks. If it does not, than the authorities must know how the economy deviates from the Walrasian world before being confident in even the qualitative effects of its policies.²

This paper analyzes the relationship between accommodation and output and price variability in an important non-Walrasian model - the real wage resistance model. In this model, rational economic actors strike bargain's in terms of actual or expected real wages but real wages adjust slowly to their full employment equilibrium values.

There are several reasons for focusing attention on this model. First, it has been widely cited as being useful for explaining wage-price behavior in the 1970's particularly in the international context.³ Second, supply shocks pose especially interesting policy dilemmas in models of real wage resistance. The initial effects of a supply shock are to raise the aggregate price level while at the same time lower the equilibrium real wage. Workers, however
at least initially try to maintain their real wages bidding up nominal wages and thereby prolonging the inflationary process. The policy authorities can either hold tight on the monetary reins and face a period of substantial unemployment necessary to force real wages down or accommodate the shock and pay the price in terms of a prolonged inflationary process.

The model developed in this paper, which draws on the work of Obstfeld (1982), has several distinct features. The first element is the assumption that real wages adjust slowly to their equilibrium values but that prices adjust more rapidly and clear the goods and money markets. This approach assumes that the transactions costs of changing wages greatly exceed the costs of changing prices and has been used by Solow and Stiglitz (1968) and Begg (1982). The second key element in the model is a reaction function describing the behavior of the monetary authorities to supply shocks. The monetary authorities will be assumed to react contemporaneously to supply disturbances and their rules will be known by the private sector.

The next section of this paper develops a continuous-time perfect foresight of a real wage resistance problem. At any point in time, nominal wages are predetermined and either monetary or real disturbances can affect output. A discrete time version of the model is developed in the third section of the paper. The discrete-time version of the model can embody any specification of the reaction function for the monetary authorities and can be readily used for simulating the effects of alternative policy rules.

The actual response of the Federal Reserve to supply shocks is the subject of investigation in section four of the paper. There is still a spirited debate today over the Fed's response to the first oil shock of the
1970s with some economists claiming the Fed adopted an inflation fighting pose and others arguing that the Fed accommodated inflation. Using a measure of supply disturbances related to one constructed by Wilcox (1983), we find that the Fed generally adopted tighter monetary policy in the face of supply disturbances.

The final section of the paper explores the effects of alternative Fed policies on the variance of output and prices. Specifically, we use the discrete-time version of the model to calculate the price, wage, and output variances for alternative policy rules and speeds of adjustment for real wages. We find that for rapid speeds of adjustment, increased accommodation does decrease output variance but the variances of prices may either rise or fall. For very slow speeds of adjustment of real wages towards their equilibrium value, increased monetary accommodation of supply shocks can actually increase the variance of output.

II. Shocks With Flexible Prices and Sluggish Real Wages

This treatment of the macroeconomics of real wage resistance draws heavily on Obstfeld's (1982) work. The model consists of two basic components, the first specifying goods and asset market equilibrium given money wages and the second describing the evolution of money wages.

Equations (1) - (4) characterize goods and money market equilibrium:

\begin{align*}
(1) \quad y &= y_{\frac{W}{P}}, \quad y' < 0 & \text{supply of output} \\
(2) \quad M &= L(y, r + \pi^e) & \text{money market equilibrium} \\
(3) \quad A(y, r) &= y \Rightarrow r = \Psi(y), \quad \Psi' < 0 & \text{goods market equilibrium} \\
(4) \quad \frac{\dot{P}}{P} &= \pi^e & \text{perfect foresight}
\end{align*}
The supply of real output depends inversely on the real wage and it is assumed that the economy operates on the labor demand curves of firms. Equation (2) is a conventional money market equilibrium condition while equation (3) is the corresponding goods market equilibrium which states that desired spending, A, equals output. Under the usual assumptions, the goods market equilibrium schedule can be inverted to yield an inverse relationship between real interest rates and the level of output. Finally, equation (4) states that prices are flexible and that, in the absence of unanticipated shocks, actual price movements equal anticipated price movement.

Substituting these relations into the money market equilibrium condition yields:

\[
\frac{M}{P} = L \left\{ y\left(\frac{W}{P}\right), \psi\left(y\left(\frac{W}{P}\right)\right) + \frac{\dot{P}}{P}\right\}
\]

which can be described as:

\[
\frac{\dot{P}}{P} = a(W, M, \psi) \quad a_W < 0 \quad a_M < 0 \quad a_P > 0
\]

An increase in money wages or the stock of money leads to a decrease in anticipated inflation. An increase in the nominal wage reduces the demand for real output and therefore for money demand and requires anticipated deflation to restore money market equilibrium. Increasing the nominal money stock also creates an excess supply of real balances requiring a decrease in anticipated inflation to equilibrate the market. Finally, an increase in the price level reduces the supply of real balances and increases the demand for real balances thereby requiring an increase in expected inflation to maintain money market equilibrium.

Nominal wages adjust both in response to the excess demand for or supply for labor and to anticipated inflation:
(7) \[ \dot{\bar{W}} = \phi[n^d(W,P) - \bar{n}] + \frac{\dot{p}}{p} \]

In this equation, \( \bar{r} \) represents the fixed level of labor supply. Using the expression already derived for the inflation rate, equation (7) can be re-written as:

(8) \[ \dot{\bar{W}} = \phi[n^d(W,P) - \bar{n}] + a(W,M,P) \]

or\[ \dot{\bar{W}} = H[W,M,P] \quad H_W < 0 \quad H_M < 0 \quad H_p > 0 \]

An increase in the current level of money wages leads to lower wage inflation because both the excess demand for labor and expected inflation are reduced. An increase in the money stock also reduces nominal wage growth because it decreases expected inflation. On the other hand, an increase in the price level increases both the demand for labor and expected inflation and therefore leads to higher wage growth.

In this model, the nominal wage is predetermined at time \( t \) while the price level is free to jump. The two equation system will have a unique saddlepoint path if the determinant of the linearized system is negative. The condition for a negative determinant is:

\[ \frac{\dot{p}}{\dot{W}} > - \left. \frac{a_W}{a_p} \frac{dP}{dW} \right| \frac{\dot{p}}{\dot{W}} = 0 \]

which also is the condition for the slope of the \( \frac{\dot{W}}{\dot{p}} = 0 \) curve to exceed the slope of the \( \frac{\dot{p}}{\dot{W}} = 0 \) curve in P-W space as presented in Figure 1.

It is not difficult to show that this condition is satisfied in the model. Consider doubling \( P \) and \( W \) from a position of equilibrium. From equation (5) is is evident that this creates excess demand for money and requires an increase in \( \frac{\dot{p}}{\dot{p}} \) to equilibrate the money market. The region of excess demand for money
Saddle-Point Path (SS)

Figure 1
lies above the \( \frac{\dot{p}}{p} = 0 \) locus; therefore, the slope of the \( \frac{\dot{p}}{W} \) line through the original equilibrium must exceed the slope of the \( \frac{\dot{p}}{p} = 0 \) locus. Thus, the condition is satisfied and the system has a unique saddle-point path SS which is also depicted in Figure 1.

Since this study focuses on supply shocks and monetary shocks, we will limit our experiments with the model to these two cases. Consider first, an unanticipated permanent increase in the money supply when the system was at rest at the equilibrium position \( E_1 \). Because the model possesses long run neutrality of money, the new equilibrium will occur at the same real wage, along the line \( \left( \frac{\dot{p}}{W} \right)^0 \), but at higher nominal wage and price levels. The new equilibrium is depicted as \( E_2 \). Initially, the price level jumps to \( p_1 \) reducing the real wage and leading to an expansion of output. Over time, however, the nominal wage adjusts and grows faster than prices thereby increasing real wages and restoring the economy to the initial level of output. During the adjustment process it appears that a "wage-price" spiral is operative and, indeed, this is the mechanism implicit in the dynamics.

The analysis of supply shocks requires some additional assumptions. For this paper, the term "supply-shock" will be associated with any change in the production technology that reduces both the level of output and the demand for labor. This means that equilibrium real wages will fall following productivity reducing supply disturbances.

Suppose the economy is in long run equilibrium at \( E_1 \) and a supply shock hits which raises the real wage. The new equilibrium will lie along a steeper ray from the origin as, for example, \( E_2 \) in Figure 3. The price level in the new equilibrium must be higher because the fall in income reduces money demand so that the price level must be higher in the long run to maintain equilibrium.
A Monetary Shock

Figure 2
A Supply Disturbance

Figure 3
Following the shock, the price level jumps to point A which lowers the real wage. However, this drop in the real wage is not sufficient to restore full employment and unemployment is required to reduce the real wage further to restore equilibrium.

Policy makers could prevent this period of unemployment by increasing the money stock so that the $\frac{\dot{W}}{W} = 0$ and $\frac{\dot{P}}{P} = 0$ loci pass through point B. If the authorities increased the money supply by just this amount, the price level would jump sufficiently, given the existing money wage, to maintain labor market equilibrium. The price of this action is, of course a higher price level. Alternatively, a decrease in the money supply could be utilized to maintain the existing price level at C but the cost of this action would be a longer spell of unemployment. This is the classic supply shock policy dilemma in the context of a rational expectations real wage resistance model.

The model has the property that money supply increases which are anticipated far enough in advance will not have any effects on real output but will just raise prices. This implies that known trends in monetary policy will have no real effects. Announcements that changes in monetary policy will be implemented in the near future will have real effects which can be analyzed along the lines of Wilson (1979) and Obstfeld (1982). The discrete-time version of the model developed in the next section encompasses both anticipated and unanticipated monetary and real shocks.

III The Discrete-Time Version

The discrete time model follows the version developed in the last section closely. All variables (except interest rates) are in logs and measured as deviations from trend. The first block of equations is:
\( y_t = -a_0(w_t - P_t) - g_0s_t \) \hspace{1cm} Supply of Output

\( m_t - P_t = a_1y_t - a_2[r_t + t_t^c - P_t] \) \hspace{1cm} Money Demand

\( y_t = \pi_1y_t - \pi_2r_t \Rightarrow r_t = \left(\frac{\pi_1 - 1}{\pi_2}\right)y_t = -a_3y_t \) \hspace{1cm} Goods Market

The variable "s_t" is a supply disturbance with the convention that positive disturbances reduce output. This disturbance will also affect the labor demand relation given below. Combining (10) - (12) and eliminating output and interest rates yields the following:

\( t_t^c = \frac{1 + k_1 + a_2}{a_2}P_t - \frac{k_1}{a_2}w_t - \frac{m_t}{a_2} - \frac{k_2}{a_2}s_t \) \hspace{1cm} \[ (13) \]

where:
\( k_1 = a_0(a_1 + a_2a_3) > 0 \)
\( k_2 = g_0(a_1 + a_2a_3) > 0 \)

Wage behavior is described as in the last section:

\( w_{t+1} - w_t = \phi[-a_4(w_t - P_t) - ags_t] + (t_t^c - P_t) \) \hspace{1cm} \[ (14) \]

or

\( t_t^c + w_{t+1} = (1-a_6)w_t + (a_6-1)P_t - a_{10}s_t \) \hspace{1cm} \[ (14') \]

where \( a_{10} = \phi a_9 \)
\( a_6 = \phi a_4 \)

If the production technology has the Cobb-Douglas form then it can be readily shown that \( k_2 > k_1 \) and \( a_{10} = a_6.5 \)

In matrix form, (13) and (14') become:

\[
\begin{bmatrix}
0 & 1 \\
1 & -1
\end{bmatrix}
\begin{bmatrix}
w_{t+1} \\
t_t^c + w_{t+1}
\end{bmatrix}
= \begin{bmatrix}
-\frac{k_1}{a_2} & \frac{1 + k_1 + a_2}{a_2} \\
(1-a_6) & (a_6-1)
\end{bmatrix}
\begin{bmatrix}
w_t \\
P_t
\end{bmatrix}
+ \begin{bmatrix}
\frac{-1}{a_2} \\
\frac{k_2}{a_2}
\end{bmatrix}
\begin{bmatrix}
m_t \\
s_t
\end{bmatrix}
\]

\[ (15) \]

Solving this matrix equation gives a solution for \( w_{t+1} \) and \( t_t^c \):
(16) \[
\begin{bmatrix}
w_{t+1} \\
p_{t+1}^e
\end{bmatrix} = \begin{bmatrix}
(1-a_6) - \frac{k_1}{a_2} & (a_6-1) + \frac{1+k_1+a_2}{a_2} \\
-\frac{k_1}{a_2} & \frac{1+k_1+a_2}{a_2}
\end{bmatrix}
\begin{bmatrix}
w_t \\
p_t
\end{bmatrix} + \begin{bmatrix}
-\frac{1}{a_2} & -\frac{k_2}{a_2} - a_0 \\
-\frac{1}{a_2} & -\frac{k_2}{a_2}
\end{bmatrix}
\begin{bmatrix}
\pi_t \\
\pi_t
\end{bmatrix}
\]

The characteristic roots of the matrix \(A\) are \((1-a_6)\) and \(1 + \frac{1}{a_2}\) respectively. This system will have a unique saddlepoint path if the absolute value of one root exceeds one and the absolute value of the other is less than one. This requires that \(0 < a_6 < 2\) which is a condition requiring that real wages cannot respond "too fast" to excess demand or supply for labor.

The general solution for models in this form has been given by Blanchard and Kahn (1980). Letting \(Z_t\) denote the vector \([\pi_t \pi_t']\), the solutions are:

\[
(17) \quad w_t = (1-a_6)w_{t-1} + \left( -\frac{1}{a_2} \right) Z_{t-1} + \sum_{i=0}^{\infty} \left( \frac{a_2}{a_2} \right)^{i+1} E[Z_{t+i}|I_{t-1}]
\]

and

\[
(18) \quad p_t = \left[ \frac{1}{(a_6-1) + \frac{1+k_1+a_2}{a_2}} \right] \left[ \frac{k_1}{a_2} w_t + \sum_{i=0}^{\infty} \left( \frac{a_2}{1+a_2} \right)^{i+1} E[Z_{t+i}|I_t] \right]
\]

where:

\[
Y = \left[ \frac{1}{a_2} \left[ \frac{1+a_2}{a_2} - (1-a_6) \right] \right] \left[ \frac{k_2}{a_2} \left( \frac{1}{a_2} \right) + a_0(1 - \frac{k_1}{k_2}) \right] > 0
\]

Several aspects of the solution are of note. First, the expectational component of nominal wages at time \(t\) is formed from expectations taken at time \(t-1\) because wages are predetermined at time \(t\). On the other hand, prices are not predetermined at time \(t\) and depend on current period expectations of the exogenous variables. Second, the conditions on the characteristic roots that guarantee a unique solution and those derived from the Cobb-Douglas
specification ensure that both the leading term in the price equation and Y are greater than zero. This implies that expected increases in the money supply or in supply shocks raise prices as intuition suggest. Finally, as customary in rational expectation models, the unstable root \( \frac{1+a_2}{a_2} \) is solved "forward" while the stable root \((1-a_6)\) is solved "backwards" in Sargent's (1979) terminology. The discount factor for future expectations depends solely on the parameter \( a_2 \), the interest semi-elasticity of money demand with respect to real interest rates. The reason this coefficient is so important is that the goods and money markets are equilibrated in the model through changes in expected inflation which operates through nominal interest rates.

As it stands, the model can be simulated if it is given parameter values and series for expectations of the endogenous variables. The next section of the paper provides evidence on the policies actually adopted by the Federal Reserve in the face of supply disturbances in the post-war era.

IV. The Fed's Response to Supply Shocks

For this empirical study we focus on deviations from trends and leave aside the important issue of the determination of trend inflation and output growth. Prices and wages are measured as residuals of regressions of the first difference of the logs of each variable on a linear time trend. Supply shocks are measured as the first difference in the ratio of the import price deflator to the GNP deflator. The idea of using a ratio of import prices to overall prices is due to Wilcox (1983) although his measure differs slightly from the one used here.\(^6\)
Treating the supply shocks for the moment as exogenous, equation (1) in Table I tells the basic story about the Fed's behavior. Money growth clearly decelerates in the presence of supply shocks as the negative and significant coefficient on the current supply shock term indicates. A change in the supply shock variable of one standard deviation implies a change of .26 standard deviations in money growth. As equation (2) also shows, this same pattern prevails over the shortened sample period of 1966:4 to 1980:4 as compared to the original sample period of 1950:4 to 1980:4. As the low R²'s indicate, other factors certainly are important in determining the behavior of the money stock but supply shocks have a pronounced negative effect.

Equations (3) and (4) shed some light on whether the supply disturbances can be taken exogenous in the money growth equation. In equation (3), the supply shock variable is regressed on a constant and two lagged values of itself; in equation (4), two lagged values of money are added. The "F" statistic for the inclusion of the two lagged values of money is 1.36 which is less than the critical value of 3.07 for F (2,116) at the five percent level. These Granger-test results suggest that even although there is a theoretical possibility that our measure of supply shocks is related to money growth (perhaps through the exchange rate in a flexible exchange rate regime), this was not, in fact, the case during the sample period under examination. To a first approximation, supply shocks can be taken as exogenous to money growth.

Equations (17) and (18) in the last section require formulas for expectations of future money stocks and supply shocks. With a vector autoregressive representation of the joint money-supply shock process, the
<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Period</th>
<th>Constant</th>
<th>S</th>
<th>M(-1)</th>
<th>S(-1)</th>
<th>M(-2)</th>
<th>S(-2)</th>
<th>d.w.</th>
<th>R²</th>
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</thead>
<tbody>
<tr>
<td>1. M</td>
<td>1950:4 - 1980:4</td>
<td>.034</td>
<td>-.718</td>
<td>(.677)</td>
<td>(.234)</td>
<td></td>
<td></td>
<td>2.02</td>
<td>.18</td>
</tr>
<tr>
<td>2. M</td>
<td>1966:1 - 1980:4</td>
<td>-1.04</td>
<td>-.772</td>
<td>(.91)</td>
<td>(.428)</td>
<td></td>
<td></td>
<td>1.92</td>
<td>.18</td>
</tr>
<tr>
<td>4. S</td>
<td>&quot;</td>
<td>.076</td>
<td>.045</td>
<td>(.210)</td>
<td>(.027)</td>
<td>.645</td>
<td>(.094)</td>
<td>-0.012</td>
<td>-.011</td>
</tr>
<tr>
<td>5. M</td>
<td>&quot;</td>
<td>-.006</td>
<td>.292</td>
<td>(.692)</td>
<td>(.086)</td>
<td>-.505</td>
<td>(.244)</td>
<td></td>
<td>1.95</td>
</tr>
<tr>
<td>6. S</td>
<td>&quot;</td>
<td>.077</td>
<td>.042</td>
<td>(.208)</td>
<td>(.025)</td>
<td>.636</td>
<td>(.073)</td>
<td></td>
<td>1.98</td>
</tr>
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</table>

Standard errors in parentheses
formulas of Hansen and Sargent (1980) are available to calculate the expected discounted sums in equations (17) and (18). After some experimentation, a first order vector autoregressive process was found adequate to capture the behavior of the joint stochastic process. Equations (5) and (6) in Table I contain the estimates of this process for the full sample. An "F" test reveals that the coefficients of this relationship were stable over the two sub-periods 1950:1 -1965:4 and 1966:1 -1980:4. The general process can be written as:

\[ Z_t = H Z_{t-1} + W_t \quad Z_t = \begin{bmatrix} m_t \\ s_t \end{bmatrix} \]

where \( W_t \) is a vector white-noise process. With this representation the formulas from Hansen and Sargent imply:

\[ \sum_{i=0}^{\infty} \alpha^{i+1} E_t[Z_t | I_t] = \alpha H^{-1}(\alpha) Z_t \]

This formula was used to derive a closed form expression for equation (18) and with a slight modification to account for the difference in dating, for equation (17) as well.

V. Alternative Policy Rules

Before simulating the model under alternative policy rules, it is necessary to distinguish between reduced form and structural disturbances to the system. Based on the empirical work in the last section, we assume that the structural equations governing the Fed's behavior has the form:

\[ M_t = \alpha S_t + \beta M_{t-1} + \epsilon_t \]
\[ S_t = \gamma_2 M_{t-1} + \gamma_1 S_{t-1} + n_t \]

where \( \epsilon_t \) and \( n_t \) are structural disturbances.
The reduced form for this system will then be:

\[
\begin{align*}
M_t &= (\beta + \alpha_2) M_{t-1} + (\alpha y_1) S_{t-1} + \varepsilon_t + \alpha_\eta_t \\
S_t &= \gamma_2 M_{t-1} + \gamma_1 S_{t-1} + \eta_t
\end{align*}
\]

Our procedure was to first estimate the reduced form. Given the structural specification, it is possible to recover estimates of the structural parameters and the structural errors. Alternative simulation experiments consist of changes of \( \alpha \), the contemporaneous relation of \( M \) to \( S \). Alternative values of this parameter generate different parameter values for the reduced form and different reduced form disturbances. These new reduced form coefficients and new reduced form disturbances are then used as the stochastic processes which become the forcing variables in the wage and price equations. In summary, different values of \( \alpha \), the accommodation parameter, are used to generate different values of the stochastic processes for money and supply shocks which then become inputs into the wage and price equations. The reduced form disturbances become the "shocks" that then impinge on the system in every period.

Table II reports the results of dynamic simulations of the wage and price equations for the period 1950:4 - 1980:4 using the appropriate reduced form coefficients and disturbances for alternative values of \( \alpha \). Simulations were conducted for three values of the accommodation parameter (-.7944, 0, .7944) and three alternative speeds of adjustments (.897, .6, .25). The standard deviation reported for output is actually the standard deviation of output divided by \( a_0 \). This expression is calculated using the simulated series for \( W, P, \) and \( S \) in equation (10) and noting that \( \frac{g_0}{a_0} = \frac{k_2}{k_1} \).
Table II

Standard Deviations of Output, Prices and Wages

<table>
<thead>
<tr>
<th>Standard Deviations of:</th>
<th>( \alpha = -0.7944 )</th>
<th>( \alpha = 0 )</th>
<th>( \alpha = 0.7944 )</th>
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<tbody>
<tr>
<td>( Y )</td>
<td>3.277</td>
<td>3.106</td>
<td>2.540</td>
</tr>
<tr>
<td>( P )</td>
<td>0.714</td>
<td>0.662</td>
<td>1.429</td>
</tr>
<tr>
<td>( W )</td>
<td>3.682</td>
<td>3.805</td>
<td>2.951</td>
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\( a_6 = 0.6 \)

<table>
<thead>
<tr>
<th></th>
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<th>( \alpha = 0 )</th>
<th>( \alpha = 0.7944 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Y )</td>
<td>3.8177</td>
<td>3.7267</td>
<td>3.293</td>
</tr>
<tr>
<td>( P )</td>
<td>1.145</td>
<td>1.063</td>
<td>1.335</td>
</tr>
<tr>
<td>( W )</td>
<td>5.071</td>
<td>5.274</td>
<td>4.664</td>
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</table>

\( a_6 = 0.25 \)

<table>
<thead>
<tr>
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<th>( \alpha = 0 )</th>
<th>( \alpha = 0.7944 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Y )</td>
<td>12.8053</td>
<td>12.8775</td>
<td>12.8390</td>
</tr>
<tr>
<td>( P )</td>
<td>7.0239</td>
<td>7.0138</td>
<td>6.7119</td>
</tr>
<tr>
<td>( W )</td>
<td>20.441</td>
<td>20.679</td>
<td>20.497</td>
</tr>
</tbody>
</table>

Other parameter values:

- \( k_1 = 1.397 \)
- \( k_2 = 2 \)
- \( \sigma_2 = 6.63 \)
The results indicate that increased accommodation of supply shocks (increased values of $\alpha$) reduces the standard deviation of output only if the speed of adjustment of real wages towards their equilibrium value is sufficiently high. For low speeds of adjustment, increased accommodation can actually lead to increased variance in output. Even in this relatively simple model of real wage resistance, the interactions between policy rules and the internal dynamics of the model (arising through the lag structure) are sufficiently complex to make any simple relation between stability of output and the contemporaneous response of money to supply shocks unlikely. The estimated policy rules combine both contemporaneous reactions to unanticipated disturbances as well as anticipated future policy in the face of past disturbances. This combination of anticipated and unanticipated policy components introduces significant dynamic interactions within the model precluding any simple relationships. For any level of accommodation, however, the variance of all the variables decreases as the speed of adjustment increases.

There are no clear patterns relating the variance of prices and wages to increased accommodation. Sometimes the variances increase with accommodation - other times they decrease. Taking all the results together, there is no clear presumption of a trade-off between price and output variability that is available to policy makers.

VI Conclusion

This study discovered that the Fed has taken a contractionary stance toward supply shocks during the post-war era. There is no assurance, however, from rational expectations models of real wage resistance that this policy
produced a reduction in the variance in prices at the expense of increased variance in output. Increased accommodation does appear to decrease the variance of output when the adjustment speed of real wages is sufficiently rapid. However, for slow adjustment speeds, this relationship may reverse itself and, in all cases, there is no clear relationship between the variance of prices and accommodation. If rational expectation real wage resistance models are viewed as capturing important features of the business cycle, the conventional trade-offs between output and price variability do not exist.
Footnotes

1. See, for example, Fischer (1977) and Taylor (1980).

2. It is known that the presence of imported intermediate goods or interest costs in production can break the link between accommodation and increased variance of prices. See Dornbusch (1982) and Driskill and Sheffrin (1982).

3. Sachs (1979) has stressed the role of real-wage resistance in impeding adjustments to supply shocks. Solow (1980) also analyzes supply shocks using the Solow-Stiglitz (1968) wage-price sector which is one version of a real-wage resistance model. His analysis is most applicable to the effects of a one-time unanticipated change in aggregate demand rather than an analysis of systematic policy towards supply disturbances.

4. The slopes of the loci may change after the shock.

5. With the production function (in logs) given by \( y = a + \alpha n \), profit maximizing behavior implies labor demand will be: \( n^d = \frac{w-p-a-\alpha}{\alpha-1} \) and output supply will be \( y = a + \left( \frac{\alpha}{\alpha-1} \right) [w-p-a-\alpha] \). Thus a productivity shock (a change in \( \alpha \)) has a larger effect on output than a change of the real wage of equal magnitude but productivity shocks and real wage changes have the same effect on labor demand.

6. Wilcox adjusted the import deflator-GNP deflator ratio by the exchange rate.
References


