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RELATIVE UNCERTAINTY OF PRICE AND OUTPUT IN FARM AND NONFARM SECTORS

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Abstract

Uncertainty about inflation, nonfarm output growth, and farm output growth is analyzed using a multivariate GARCH-M model. The results indicate that the uncertainty affecting the economy is caused by real shocks, and not by nominal shocks. Uncertainty about nonfarm output growth affects both nonfarm output growth and the inflation rate. Farm output growth is not affected by uncertainty over nonfarm output growth.

I. Introduction

Economists have long been interested in the macroeconomic effects of inflation on real output. This line of reserch has been extremely active in the past two decades, spurred on by periods of slow growth and high inflation - the so-called stagflation - in the 1970's. It is now widely accepted that the level of inflation has little effect on real output apart from those effects arising from institutional features such as nonindexed tax codes, nominal wage contracting, and zero interest on bank reserves. At the same time, many suggest that uncertainty about future inflation rates affects real variables. Over one hundred years ago, Alfred Marshall(1886) expressed concern about the negative effects on the economy of an uncertain future value of the English pound. This concern is still with us today.

Perhaps the best known modern statement on this issue is con-

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tained in Milton Friedman's Nobel Lecture. Friedman argued that greater inflation uncertainty would shorten the length of contracts and in general reduce the efficiency of the price system, thereby lowering output growth.

A number of studies have attempted to analyze the empirical validity of Friedman's conjectures. Okun(1971) provided early evidence of a positive relation between the mean and variance of inflation across countries, and Logue and Sweeney(1981) found that both the mean and variance of inflation are positively correlated with the variance of output across countries. One problem with both of these studies is that they assume a constant inflation variance for each individual country, eliminating the possibility of testing Friedman's conjecture within a single country.

More recently, Katsimbris(1985) allows the variance of inflation and output growth to change through time, and looks at both within-country and across-country correlations. He reports that only a few countries exhibit a positive correlation between the mean and variance of inflation, and even fewer exhibit a positive correlation between inflation variance and the variance of output growth. Thornton(1988) conducts a similar exercise and reaches the same conclusion. In particular, neither author finds a relationship between inflation uncertainty and output growth for the United States.

One problem with the above studies is that the measure of the mean and variance of inflation are constructed as eight quarter rolling averages. These measures are ad-hoc both statistically and economically, making the results difficult to interpret and leaving open the question of whether a more formal model might find support for Friedman's conjecture. One alternative methodology is to use the formal statistical models of time-dependent heteroskedasticity available in Engle's(1982) ARCH(or autoregressive conditional heteroskedasticity) model. These models are tailor made for analyzing issues of time dependent heteroskedasticity, and recent innovations to these models such as by Engle, Lilien, and Robins(1987) allow estimation and testing of the relationship between conditional means and variances via the so-called ARCH-M(ARCH in mean) model. Employing this approach, Jansen(1989) models U.S inflation and output growth as a bivariate GARCH-M model in an attempt to find a relationship between output growth and inflation uncertainty. However, he fails to detect any significant relationship between these variables.

In spite of these negative results, it is still possible that inflation uncertainty affects the economy, not through its effects on aggregate output growth, but through its effects on the allocation of production across sectors of the economy. In agricultural economics, there has been considerable interest in the differential effect of monetary policy on the farm and nonfarm sectors of the economy. The relatively flexible price markets for agricultural products have been postulated to provide a quicker transmission of inflation to the agricultural sector relative to the manufacturing sector. In a recent paper, Han, Jansen, and Penson(1990) analyze the relationship between money, agricultural prices, and industrial prices using ARCH modeling in a vector autoregression, and report that all three variables exhibit conditional heteroskedasticity. Moreover, in their work it appears that both the mean and the variance of agricultural prices are more sensitive than industrial prices to the mean and variance of money.

The aim of the present study is to examine farm and nonfarm output growth and inflation, in an attempt to identify avenues by which inflation uncertainty might exert differential effects on output growth across farm and non-farm sectors. This study also looks at the dynamic interactions between the means and variances of inflation, farm and nonfarm output growth, in order to identify channels of influence. Our main focus is to analyze whether inflation uncertainty exerts a negative effect on either farm or non-farm output growth.

II. Preliminary Data Analysis

Quarterly data on the real farm output(FY), real nonfarm output (NFY), and the GNP deflator(P)for the period 1960:1 through 1988:4 are used in this analysis.[1] All variables were transformed to natural

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[1] Our output and price measures were provided by quarterly data on Gross Domestic Product in nonfarm and farm sectors and on the GNP Deflator, obtained from the *Survey of Current Business* (U.S. Department of Commerce). Note that GDP is defined as output produced by factors of production located in the domestic economy. For the United States, there is little difference between GDP and GNP. In recent years, the contribution to U.S. GNP due to factors located abroad was less than one percent of GNP, so we felt comfortable using these measures of farm and nonfarm output.

logs before estimation, and Dickey-Fuller tests[2] for unit roots were conducted. These tests are reported in Table 1. In levels, we cannot reject the unit root hypothesis for any variable at the 5 percent significance level with the τ_μ test or the $\tau_\tau$test. After first differencing all the series, we tested for a further unit root with the τ_μ test. At the 5 percent significance level we could reject a unit root in differences of farm and non-farm output, but not in differences of the GNP deflator.[3] Jansen(1989) reports a similar finding and uses information from related time series to argue that the GNP deflator is stationary in differences. He shows that Dickey-Fuller tests indicate that the logs of real GNP, M1, and M1 velocity(defined as nominal GNP divided by M1)are all stationary after first differencing. Since the log of the price level (in first differences) is just a linear combination of these three series, it should be stationary too. That is, since the first differenced price series is by definition equal to the sum of three stationary series, then it is stationary. Failure to reject the null hypotheses of a unit root via the Dickey Fuller tests might be due to the low power of a such tests when time series exhibit strong persistence, which the inflation series does.

A further preliminary issue is the possibility of co-integration among the variables in thes study. This study specifies a vector autoregression(VAR) in the difference of the three variables, FY, NFY, P. If these variables are cointegrated, an error correction model (ECM) is more appropriate, as the VAR in differences misspecified.

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[2] The Dickey-Fuller τ_τ tests are implemented by estimating the following regression for each series:

$$\Delta X_t = \alpha + \beta X_{t-1} + \gamma t + \varepsilon_t$$

where Δ is the difference operator, X is the variable being tested, α, β and γ are parameters to be estimated, t is a time trend and ε_t is an error term. If the value of the t-ratio associated with the lagged level term is less than the critical value tabulated by Dickey- Fuller, then the hypothesis of a unit root is rejected. The Dickey-Fuller τ_μ tests are obtained by estimating above regression equation without a time trend. The τ_τ test is more powerful than the τ_μ test when the alternative hypothesis is that the data series is stationary around a deterministic trend.

[3] It is well known that the Dickey-Fuller tests have low power against the alternative of a root close to but less than one. In addition, Schmidt has provided modifications of the Dickey-Fuller critical values for the case of a statistically significant drift term in the regression. These critical values are lower in absolute value than the values tabulated by Fuller, and would indicate a rejection of the unit root hypotheses for the inflation rate.

We employ the test of Johansen(1988) and Johansen and Juselius (1989). This test can not only detect co-integration but also indicate the number of co-integrating vectors for a set of data.[4] Test results reported in Table 1 do not indicate co-integration among the three variables.

TABLE 1 Tests for Unit Roots and Co-Integration

Unit Root Tests

Variable	τ_{μ}	τ_{τ}
log(FY)	-2.37	-3.42
log(NFY)	-1.29	-3.29
log(P)	-0.42	-2.33
△log(FY)	-3.99	
△log(NFY)	-4.73	
△log(P)	-2.08	

Approximate critical values for rejecting unit root hypothesis

Significance Levels	Critical Values	
	τ_{μ}	τ_{τ}
10%	-2.58	-3.15
5%	-2.89	-3.45

Johansen Trace Test for Co-integration

Null Hypothesis on Number of Co-integration Vectors	Test Statistic	5% Critical Value
0	21.14	31.3
1	8.26	17.8
2	0.15	8.1

[4] The co-integration tests suggested by Engle and Granger is the Augmented Dickey-Fuller test on the residuals of the co-integrating regression. This testing methodology is less flexible and subject to difficulties of interpreting conflicting results resulting from alternative arbitrary normalizations.

III. The VAR Model

The lag structure of the VAR model was specified using Hsiao's method of applying Akaike's Final Prediction Error(FPE) criterion. This commonly used procedure has recently been used by Bradshaw and Orden(1990). Since Hsiao's specification procedure is applied equation by equation, the VAR model chosen by this procedure was deliberately overfit and underfit to assure that the specification was supported in the multivariate system. The overfit model was generated by specifying that each equation contained one additional lag of each of the right-hand side variables from the FPE specification. The underfit model was generated by eliminating lags with low t statistics from the estimated FPE model. Likelihood ratio tests indicate that the FPE specification was not rejected when compared to the overfit and underfit models. Parameter estimates of this model are provided in Table 2.

TABLE 2 The Homoskedastic VAR

$$FY_t = \underset{(-0.006)}{-0.00004} - \underset{(-3.61)}{0.338}\, FY_{t-3} \qquad R^2=0.09 \qquad S=0.063$$

$$NFY_t = \underset{(4.40)}{0.009} + \underset{(4.10)}{0.348}\, NFY_{t-1} - \underset{(-2.43)}{0.323}\, P_{t-1} \qquad R^2=0.21 \qquad S=0.01$$

$$P_t = \underset{(2.09)}{0.02} - \underset{(-2.27)}{0.014}\, FY_{t-1} + \underset{(4.84)}{0.423} P_{t-1} + \underset{(2.23)}{0.209} P_{t-2} + \underset{(2.77)}{0.243} P_{t-3} \qquad R^2=0.65 \qquad S=0.004$$

$$\begin{vmatrix} \varepsilon_{FY} \\ \varepsilon_{NFY} \\ \varepsilon_{P} \end{vmatrix} = \begin{vmatrix} 0.0039 & & \\ -0.0001 & 0.0001 & \\ -1.93E\text{-}07 & -3.23E\text{-}06 & 0.00002 \end{vmatrix}$$

Log likelihood value = 1004.39

Note :

i) S is the standard error of regression.

ii) Parenthetical values below parameter estimates are t-statistics.

The VAR model was subject to diagnostic tests for serial correlation, structural stability, and multivariate autoregressive conditional heteroskedasticity(or ARCH). Test results are summarized in Table 3. Godfrey's test for serial correlation, valid in the presence of lagged endogenous variables, indicated no serial correlation of orders one through four. The test for structural change allowed all intercept and slope coefficients to change in 1973, the year of the first oil shock and the demise of the Bretton Woods System of pegged exchange rates. At the 5% significance level, the test indicated no structural change between the two subperiods.[5]

TABLE 3 Diagnostic Test on Homoskedastic Model

A. Godfrey Test for Serial Correlation

Order	Farm Output Growth		Nonfarm Output Growth		Inflation Rate	
	Test Statistic	$P>x^2$	Test Statistic	$P>x^2$	Test Statistic	$P>x^2$
1	0.9776	0.323	0.6422	0.423	1.2518	0.263
2	1.2056	0.547	3.0078	0.222	1.2559	0.534
3	1.4043	0.905	3.0347	0.386	1.4814	0.687
4	2.9360	0.569	3.6126	0.461	1.5835	0.812

B. Multivariate ARCH Test

Order of ARCH	Test Statistic	Degree of Freedom	$P>x^2$
1	37.63	9	0.000
2	76.94	18	0.000
3	157.21	27	0.000
4	173.89	36	0.000

C. Test for Structrual Change

Sub sample: Ⅰ/1960 – Ⅳ/1973, Ⅰ/1974 - Ⅳ/1988.

Likelihood ratio test statistic: $16.35 \sim x^2(10)$ $P>x^2$: 0.09

[5] The marginal significance level is 9%, indicating the evidence favoring the null is by no means overwhelming.

Finally, multivariate ARCH was tested using the Lagrange multiplier test suggested by Engle, Granger, and Kraft. The null hypothesis is homoskedasticity, and the alternative hypothesis specified one through four lags of the squared VAR residuals entered in each conditional variance equation. This test strongly rejects homoskedasticity, indicating that the VAR model should be respecified as an ARCH model.[6]

IV. The Multivariate GARCH-M Model

Engle's ARCH model allows a parametric specification of time dependent conditional variances for time series models. Engle, Lilien, and Robins extend this to the ARCH-M, which allows the time dependent conditional variance to affect the conditional mean of the dependent variables in the time series model. They estimate an ARCH-M model of the term structure in which the risk premium is time-varying, and the risk premium affects the holding-period yield. A closely related extension is the multivariate GARCH-M model used by Bollerslev, Engle and Wooldridge to estimate a capital asset pricing model. GARCH models generalize the parametrization of the conditional variance used in ARCH models.

The ARCH-M and GARCH-M models allow the conditional variances to affect the conditional means. For our purpose, these models allow the explicit parameterization and estimation of time-varying inflation and output uncertainty in farm and nonfarm sectors. Further, they allow tests of hypotheses about the effect of the time-varying inflation and output uncertainty on the conditional means of farm and nonfarm output, and on the inflation rate.

The GARCH-M model can be briefly described with the following three equations. The extension to the multivariate model is straightforward.

$$y_t = x_t\beta + (h_t)^{0.5}d + \varepsilon_t \quad (1)$$

$$\varepsilon_t | I_{t-1} = N(0, h_t) \quad (2)$$

$$h_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \gamma_j h_{t-j}\ ;\ \alpha_i,\ \gamma_i > 0 \quad \forall\, i, j. \quad (3)$$

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[6] Note that estimation methods which ignore this heteroskedasticity in the VAR leads to inefficient parameter estimates and generally biased test statistics.

Equation(1) is the equation describing the conditional mean of y_t. Note that the conditional variance of y_t, h_t, enters explicitly. This is the feature that makes this model GARCH-M. Equation(2) states that the conditional destribution of ε_t is normal. Finally, equation (3) is the GARCH specification for the conditional variance. The conditional variance evolves through time depending on past realizations of the disturbances and past values of h_t itself. This model nests both the GARCH model (if d=0) and the homoskedastic VAR (if h_t is constant for all t).

The multivariate GARCH-M model estimated here is the homoskedastic VAR reported above, amended to specify that the conditional covariance matrix of the disturbances is GARCH, and to specify that the conditional variances enter the equations for the dependant variables. The off-diagonal elements of the covariance matrix of the disturbances are specified as constants, while the diagonal elements are given by:

$$\begin{vmatrix} Var(\varepsilon_{FY.t}) \\ Var(\varepsilon_{y.t}) \\ Var(\varepsilon_{p.t}) \end{vmatrix} = \begin{vmatrix} \alpha_{01} \\ \alpha_{02} \\ \alpha_{03} \end{vmatrix} + \begin{vmatrix} \alpha_{11}\alpha_{12}\alpha_{13} \\ \alpha_{21}\alpha_{22}\alpha_{23} \\ \alpha_{31}\alpha_{32}\alpha_{33} \end{vmatrix} \begin{vmatrix} \varepsilon^2_{FY.t-1} \\ \varepsilon^2_{y.t-1} \\ \varepsilon^2_{p.t-1} \end{vmatrix} + \begin{vmatrix} \gamma_{11}\gamma_{12}\gamma_{13} \\ \gamma_{21}\gamma_{22}\gamma_{23} \\ \gamma_{31}\gamma_{32}\gamma_{33} \end{vmatrix} \begin{vmatrix} Var(\varepsilon_{FY.t-1}) \\ Var(\varepsilon_{y.t-1}) \\ Var(\varepsilon_{p.t-1}) \end{vmatrix}$$

Estimates of the GARCH-M model are reported in Table 4. The model reported there was obtained by conducting a series of estimations and tests. The initial specification of the multivariate GARCH model was estimated, and parameters in the conditional variance equations were eliminated by dropping those that were not statistically significant. The model then estimated indicates that the variance of inflation does not show any ARCH process, while the variance of both nonfarm and farm output exhibit ARCH. The lack of ARCH in the inflation series may not be surprising, since several recent studies (e.g. Engle; Cosimano and Jansen; Rich, Kanago and Raymone) also report difficulty in detecting ARCH in inflation data. The GARCH-M model was estimated including the conditional variances of both farm and nonfarm output in the equations describing the conditional means of the three independent variables(nonfarm and farm output, and inflation). In this case the conditional variance of farm output had insignificant coefficients in all three equations, and the conditional variance of nonfarm output had an insignificant coefficient in the equation for farm output. In addition, the coefficients on the first and second lag of farm output were set to zero in the farm output equation, since they had t-statistics of trivial magnitude. All of these insignificant coefficients were set to zero in order to improve the functioning of the numerical algorithm generating the estimates. After restricting these coefficients to zero, we obtained estimates of the GARCH-M model reported in Table 4.

TABLE 4 The Multivariate GARCH-M Model

$$FY_t = \underset{(0.25)}{0.0007} - \underset{(-1.69)}{0.1029}\ FY_{t-3}$$

$$NFY_t = \underset{(6.45)}{0.011} + \underset{(7.91)}{0.513}\ NFY_{t-1} - \underset{(-4.37)}{0.387}\ P_{t-1} - \underset{(-2.11)}{0.34}\ Var(NFY)_t^{0.5}$$

$$P_t = \underset{(0.43)}{0.0004} - \underset{(-3.13)}{0.013}\ FY_{t-1} + \underset{(6.96)}{0.427}\ P_{t-1} + \underset{(3.51)}{0.224}\ P_{t-2} + \underset{(3.38)}{0.205}\ P_{t-3} + \underset{(1.64)}{0.148}\ Var(NFY)_t^{0.5}$$

$$Var(FY)_t = 0.027 + \underset{(9.18)}{0.705}\ e^2_{FY,t-1} + \underset{(7.11)}{0.552}\ Var(FY)_{t-1}$$

$$Var(NFY)_t = 0.004 + \underset{(5.93)}{0.749} e^2_{NFY,t-1}$$

$Var(P)_t$ = .0000168

$Cov(FY,NFY)_t$ = -.000087

$Cov(FY,P)_t$ = -.000024

$Cov(NFY,P)_t$ = -.0000069

Log Likelihood Value =1031.97

Test against homoskedastic model : $55.16 \sim \chi^2(5)$ $P > \chi^2 = .000$

Test against GARCH : $1.72 \sim \chi^2(2)$ $P > \chi^2 = .42$

The likelihood ratio test support the GARCH-M model against the VAR. The coefficients on the conditional variance of nonfarm output growth in the equations for the mean of nonfarm output growth and inflation are significant at the 5 and 10 percent level, respectively.[7] The signs of coefficients indicate that the conditional variance of nonfarm output is positively related to the inflation rate and negatively related to growth of nonfarm output. On the other hand, the conditional mean of farm output growth is not affected by the conditional variances of either inflation or nonfarm output growth.[8]

The estimates also indicate that the conditional variance of farm output is not itself a function of the variance of either non-farm output or inflation. Thus these estimates would suggest that farm output is fairly separate from the rest of the economy, although the growth rate of farm output does affect the inflation rate.

These results indicate that the uncertainty affecting the economy is caused by real shocks, not nominal shocks. Uncertainty about real nonfarm output growth, as measured by the conditional variance, affects both nonfarm real output growth and the inflation rate. Since the inflation rate does not exhibit ARCH, uncertainty about the inflation rate cannot affect output growth or feed back to the mean inflation rate. Finally, farm output growth is not affected by uncertainty about nonfarm output growth.

As a final check on model adequacy, a multivariate GARCH-M model was estimated which allows for a structural break in the model between the first subperiod, I/1960-IV/1973, and the second period I/1974-IV/1988. Our test for structural change based only on changes in the conditional mean, as reported in Table 3, allowed a rejection of the null of structural change only at the 9% significance level. Allowing for changes in the structure of the conditional variance could easily change the result of this test, so we estimated the GARCH-M

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[7] One caveat to these results is that the GARCH model is supported in a likelihood ratio test relative to the GARCH-M model. This indicates failure to reject the hypothesis that the individually significant coefficients on the conditional variances in the nonfarm output and inflation equations are jointly zero.

[8] This result may not be as surprising as it first appears, since federal farm programs may serve to insulate farm output. Concurring evidence is the low participation rate and high loss ratio found in studies of farm crop insurance. This is commonly explained by farmers practicing self insurance through diversification of production(Wright and Hewitt), the "insurance" provided by the government farm program itself(Gardner), and the existence of moral hazard in the insurance program (Quiggin). The lack of interest in farm crop insurance is circumstantial evidence that farm output is not regarded as a risk worth insuring, and the federal farm program may be the reason that this is the case.

TABLE 5 Structural Breaks in the Multivariate GARCH-M Model

$$FY_t = \underset{(1.42)}{-.003658} + \underset{(1.39)}{.008225D_t} + (\underset{(1.31)}{-.1175}+\underset{(.39)}{.046D_t})\,FY_{t-3}$$

$$NFY_t = \underset{(3.40)}{.02165} \underset{(1.53)}{-.01826D_t} + (\underset{(2.57)}{.2640} + \underset{(1.62)}{.2188D_t})NFY_{t-1}$$

$$+ (\underset{(.97)}{-.1315} - \underset{(1.54)}{.2997D_t})\,P_{t-1} + (\underset{(2.04)}{-1.547}+\underset{(1.60)}{2.078D_t})Var(NFY_t)^{0.5}$$

$$P_t = \underset{(1.05)}{-.003522} - \underset{(.99)}{.00488\,D_t} + (\underset{(.62)}{-.005421} + \underset{(1.12)}{.01134D_t})\,FY_{t-1}$$

$$+ (\underset{(3.18)}{.2872}-\underset{(2.05)}{.2620D_t})P_{t-1}+(\underset{(3.20)}{.2874}+\underset{(1.11)}{.1486D_t})P_{t-2}$$

$$+ (\underset{(2.83)}{.2653}+\underset{(.43)}{.0553D_t})P_{t-3} + (\underset{(1.65)}{.6568}+\underset{(1.18)}{.6633D_t})Var(NFY_t)^{0.5}$$

$$Var(FY)_t = .000378 + .001211\,D_t + \underset{(8.58)}{.7420e^2_{FY.t-1}} + \underset{(8.03)}{.5923\,Var(FY)_{t-1}}$$

$$Var(NFY)_t = 5.641 \cdot 10^{-5} + 8.630 \cdot 10^{-5}D_t + \underset{(3.77)}{.4938e^2_{NFY.t-1}}$$

$$Var(P_t) = 1.624 \cdot 10^{-5} + 4.183 \cdot 10^{-4}D_t$$

$$Cov(FY,NFY)_t = -9.753 \cdot 10^{-5} - 2.852 \cdot 10^{-6}\,D_t$$

$$Cov(FY,P)_t = 2.161 \cdot 10^{-6} + 4.010 \cdot 10^{-4}D_t$$

$$Cov(NFY,P)_t = -2.539 \cdot 10^{-6} + 1.030 \cdot 10^{-4}D_t$$

Log Likelihood Value = 1053.23

Test against GARCH-M without structural change 42.5 $\sim \chi^2$ (17) $P > \chi^2 = .001$

Test against GARCH with structural change 11.2 $\sim \chi^2$ (4) $P > \chi^2 = .024$

$$D_t = \begin{cases} 0 & \text{I/1960 - IV/1973} \\ 1 & \text{I/1974 - IV/1988} \end{cases}$$

model allowing for the possibility of structural change. The results are reported in Table 5. The first thing to be said is that the null hypothesis of no structural change is strongly rejected(marginal significance level 0.001). Second, the null hypothesis of GARCH instead of GARCH-M is rejected when we allow for structural change in both models.

What are the results for the individual equations? The farm output growth equation shows little effects of the change in subperiods. The nonfarm output growth equation exhibits marginally significant increases in persistence as seen in the coefficient of lagged nonfarm output growth, and a marginally significant increase in the size of the effect of lagged inflation. An interesting effect is the change in the point estimate of the effect of the variance of nonfarm output from negative to zero. Again, however, the estimate of the change in this coefficient over the subperiods is only marginally significant.

The inflation equation shows a significant decrease in persistence in the first autoregressive term. The variance of nonfarm output still exhibits a marginally significant positive effect on inflation, which does not significantly change over the subperiods.

The variance of farm output growth, nonfarm output growth, and inflation all increase between the two subperiods, with the biggest changes being order of magnitude increases in the variance of farm output growth and inflation. Nonfarm output growth variance doubles. The ARCH terms in the model for farm and nonfarm output variance did not change over the subperiod.

The overall conclusion from the model allowing structural breaks is not greatly altered from the model without the structural breaks. Inflation uncertainty increased over the subperiods, but does not exhibit ARCH. The variance of nonfarm output still contributes to the level of inflation over both subperiods.

V. Conclusions

The results presented in this paper suggest several conclusions. First, the inflation process does not appear to exhibit ARCH, and hence there is no evidence that uncertainty about the future inflation rate, as exhibited by the conditional variance, reduces output in either the farm or nonfarm sector. Second, the conditional variance of nonfarm output is positively related to the inflation rate and negatively related to the rate of nonfarm output. These results suggest that uncertainty over real output affects real and nominal values, a finding in the spirit of recent works on real business cycles. Finally, farm output is explained by past own values, does exhibit ARCH, but is not affected by the conditional variance of either nonfarm or farm output, nor does uncertainty about farm output affect nonfarm output.

This study focuses on the first two moments of the distribution of farm and nonfarm output growth, and the inflation rate. Other variable not included here but which should be considered in future work are direct measures of monetary policy actions, such as a money aggregate and/or an interest rate.

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