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Decomposition of Inflation and Its Volatility: A Stochastic Approach

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1. Introductory Remarks

2. Nonstochastic Quantity Theory of Money

$$P/P = M/M + V/V - Y/Y$$

3. Empirical Evidence

4. Illustrations of Graphs

5. Stochastic Version

$$dM(t)/M(t) = \mu_M(t,M)dt + \sigma_M(t,M)dZ_M(t)$$

$$dV(t)/V(t) = \mu_V(t,V)dt + \sigma_V(t,V)dZ_V(t)$$

$$dY(t)/Y(t) = \mu_Y(t,Y)dt + \sigma_Y(t,Y)dZ_Y(t)$$

6. Decomposition of Inflation and Its Volatility

$$\begin{aligned} E(dP/P) = \quad & E(\mu_M + \mu_V - \mu_Y \\ & + \sigma_M \sigma_V \rho_{MV} - \sigma_V \sigma_Y \rho_{VY} \\ & - \sigma_V \sigma_Y \rho_{VY} + \sigma^2_Y)dt \end{aligned}$$

$$\begin{aligned} Var(dP/P) = \quad & \sigma^2_M + \sigma^2_V + \sigma^2_Y \\ & + 2\sigma_M \sigma_V \rho_{MV} \\ & - 2\sigma_M \sigma_Y \rho_{MY} \\ & - 2\sigma_V \sigma_Y \rho_{VY})dt \end{aligned}$$

7. Empirical Evidence

8. Conclusions

$$
\begin{aligned}
dP/P &= \mu_M + \mu_V - \mu_Y \\
&\quad + \sigma_M \sigma_V \rho_{MV} - \sigma_V \sigma_Y \rho_{VY} \\
&\quad - \sigma_V \sigma_Y \rho_{VY} + \sigma^2_Y \\
&= (.0607) + (-.0196) - (.0330) \\
&\quad + (.0681)(.0725)(.7531) \\
&\quad - (.0681)(.0727)(.5129) \\
&\quad - (.0725)(.0727)(.7531) \\
&\quad + (.0727)^2
\end{aligned}
$$

$$
\begin{aligned}
\mathrm{Var}(dP/P) &= \sigma^2_M + \sigma^2_V + \sigma^2_Y \\
&\quad + 2\sigma_M \sigma_V \rho_{MV} \\
&\quad - 2\sigma_M \sigma_Y \rho_{MY} \\
&\quad - 2\sigma_V \sigma_Y \rho_{VY})dt \\
&= (.0681)^2 + (.0725)^2 + (.0727)^2 \\
&\quad + 2(.0681)(.0725)(.1304) \\
&\quad - 2(.0681)(.0727)(.5129) \\
&\quad - 2(.0725)(.0727)(.7531) \\
&= .003449
\end{aligned}
$$