THE CYCLICAL BEHAVIOR OF MONEY AND PRICES: EVIDENCE FROM THE OECD

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INTRODUCTION

Kydland and Prescott (1990) argue that business cycle research took a wrong turn when it abandoned the effort to account for the cyclical behavior of aggregate data, following Koopmans' (1947) criticism of Burns and Mitchell's (1946) methodology as being "measurement without theory." Crediting Lucas (1977) with reviving interest in business cycle research, they initiated a line of research that builds on the growth theory literature and part of it involves an effort to assemble business cycle facts. This boils down to investigating whether deviations of macroeconomic aggregates from their trends are correlated -- and at what leads and lags -- with the cycle. Kydland and Prescott (1990) report some original evidence for the U.S. economy and argue that technology shocks have been the important force driving post war U.S. business cycles. They also conclude that several accepted nominal facts, such as the procyclical movements of money and prices, appear to be business cycle myths. In particular, they argue that M1 and the price level (whether measured by the implicit GNP deflator or by the consumer price index), in contrast to the stylized fact of procyclical movements, are both counter cyclical. This evidence has important implications for the sources of business cycles and therefore for discriminating among competing models.

In view of such serious implications for theoretical work, the objective of this paper is to examine the cyclical behaviour of money and prices using quarterly data for sixteen OECD countries. In accordance with the real business cycle approach to economic fluctuations, we define the growth and cycle components of a variable as its smoothed trend and the deviation of the smoothed trend from the actual values of the variable, respectively.

The paper is organized as follows. Section II briefly discusses the Hodrick and Prescott (HP) filtering procedure for decomposing time series into long-run and business cycle components. Section III discusses the data and presents HP empirical correlations of money and prices with industrial production. The last section summarizes and concludes the paper.

METHODOLOGY

For a description of the stylized facts, we follow the current practice of detrending the data with the Hodrick-Prescott (HP) filter -- see Prescott (1986). For the logarithm of a time series X_t, for $t = 1,2,...,T$, this procedure defines the trend or growth component, denoted τ_t, for $t = 1,2,...,T$, as the solution to the following minimization problem

$$\min_{\tau_t} \sum_{t=1}^{T} (X_t - \tau_t)^2 + \mu \sum_{t=2}^{T-1} [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2$$

so that $X_t - \tau_t$ is the HP filtered series. The larger is μ, the smoother the trend path and as $\mu \to \infty$, the linear time trend results. In our computations, we set $\mu = 1{,}600$, as it has been suggested for quarterly data.

We measure the degree of comovement of a series with the cycle by the magnitude of the correlation coefficient $\rho(j), j \in \{0, 1, 2, ...\}$. The contemporaneous correlation coefficient -- $\rho(0)$ -- gives information on the

degree of contemporaneous comovement between the series and the cyclical variable. In particular, if $\rho(0)$ is positive, zero, or negative, we say that the series is procyclical, acyclical, or countercyclical, respectively. In fact, for data samples of our size it has been suggested [see, for example, Fiorito and Kollintzas (1994)] that for $0.5 \le |\rho(0)| < 1$, $0.2 \le |\rho(0)| < 0.5$, and $0 \le |\rho(0)| < 0.2$, we say that the series is strongly contemporaneously correlated, weakly contemporaneously correlated, and contemporaneously uncorrelated with the cycle, respectively. Also, $\rho(j), j \in \{1, 2, \ldots\}$ -- the cross correlation coefficient -- gives information on the phase-shift of the series relative to the cycle. If $|\rho(j)|$ is maximum for a positive, zero, or negative j, we say that the cycle of the series is leading by j periods the cycle, is synchronous, or is lagging by j periods the cycle, respectively.

DATA AND EMPIRICAL RESULTS

We study quarterly, seasonally adjusted data for sixteen OECD countries, all taken from the IMF International Financial Statistics. The price variable is the consumer price index, the output variable is the industrial production index, and the money variable is M1. All of the statistics discussed in this section pertain to variables which have been logged and processed via the Hodrick and Prescott filter -- that is, to stationary HP cyclical deviations.

Table 1 reports the contemporaneous, and the cross correlations (at lags and leads of one through five quarters), between the cyclical component of the price level and the cyclical component of output. A number near one in the x_t column indicates strong procyclical movements, and a number near minus one indicates strong countercyclical movements. The numbers in the remaining columns indicate the phase shift relative to output. For example, a series that leads (lags) the cycle by three quarters will have its maximum value in the $x_{t+3}(x_{t-3})$ column. As Table 1 shows, the price level is acyclical for Spain and countercyclical for each of the other countries and leads the cycle.

Next we turn to the statistical properties of the cyclical components of money. Table 2 reports HP cyclical correlations of money with industrial production (in the same fashion as those in Table 1 for the price level). We see that, except for Australia, Finland, and Switzerland, money is acyclical. These results clearly support the Kydland and Prescott (1990) statement that several accepted nominal facts, such as the procyclical movements of money and prices, appear to be business cycle myths.

CONCLUSION

In this paper we investigated the cyclical behavior of money and prices in sixteen OECD countries, using quarterly data and the methodology of Kydland and Prescott (1990). Based on stationary HP cyclical deviations, our results fully match recent evidence (mostly using annual data) on the countercyclicality of prices and the acyclicality of money -- see, for example, Kydland and Prescott (1990), Cooley and Ohanian (1991), Backus and Kehoe (1992), Smith (1992), Chadha and Prasad (1994), and Serletis (1996).

REFERENCES

Backus, David K. and Patrick J. Kehoe (1992), "International Evidence on the Historical Properties of Business Cycles", *American Economic Review*, **82** 864-888.

Burns, Arthur and Wesley C. Mitchell (1946), *Measuring Business Cycles*, (NBER, New York, NY).

Chadha, Bankim and Eswar Prasad (1994), □Are Prices Countercyclical? Evidence from the G7', *Journal of Monetary Economics*, **34**, 239-257.

Cooley, T.F. and L.E. Ohanian (1991), "The Cyclical Behaviour of Prices", *Journal of Monetary Economics* **28**, 25-60.

Fiorito, R. and T. Kollintzas , T. (1994), "Stylized Facts of Business Cycles in the G7 from a Real Business Cycles Perspective", *European Economic Review* **38**, 235-269.

Koopmans, Tjalling (1947), "Measurement Without Theory", *Review of Economics and Statistics* **29**, 161-172.

Kydland, Finn E. and Edward C. Prescott (Spring 1990), "Business Cycles: Real Facts and a Monetary Myth", Federal Reserve Bank of Minneapolis *Quarterly Review*, 3-18.

Lucas, Robert E. Jr. (1977), "Understanding Business Cycles", in Karl Brunner and Allan H. Meltzer, eds., *Stabilization of the Domestic and International Economy*, Vol. 5 of the Carnegie-Rochester Conference Series on Public Policy (North-Holland, Amsterdam), 7-29.

Prescott, E.C. (1986), "Theory Ahead of Business Cycle Measurement", Federal Reserve Bank of Minneapolis *Quarterly Review* **10**, 9-22.

Serletis, A. (1996), "International Evidence on the Cyclical Behaviour of Inflation", *Economics Letters* **51**, 205-212.

Smith, R. Todd. (1992), "The Cyclical Behaviour of Prices", *Journal of Money, Credit, and Banking* **24**, 413-430.

TABLE 1

HODRICK-PRESCOTT CYCLICAL CORRELATIONS OF PRICES WITH INDUSTRIAL PRODUCTION

Correlation Coefficients, $\rho(p_t, y_{t+j}), j = -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5$

Country	Sample Period	$j=-5$	$j=-4$	$j=-3$	$j=-2$	$j=-1$	$j=0$	$j=1$	$j=2$	$j=3$	$j=4$	$j=5$
Austria	1957:1 - 1995:4	0.14	-0.11	0.08	-0.07	0.05	-0.26	-0.09	-0.25	-0.12	-0.37	-0.15
Australia	1957:3 - 1997:1	0.38	0.30	0.18	0.00	-0.18	-0.36	-0.50	-0.58	-0.57	-0.52	-0.39
Belgium	1957:1 - 1996:4	-0.02	-0.06	-0.14	-0.20	-0.27	-0.34	-0.40	-0.40	-0.38	-0.31	-0.30
Canada	1957:1 - 1997:1	0.16	0.01	-0.15	-0.31	-0.46	-0.60	-0.66	-0.69	-0.66	-0.60	-0.51
Finland	1957:1 - 1997:1	-0.12	-0.19	-0.25	-0.34	-0.40	-0.46	-0.44	-0.43	-0.40	-0.35	-0.25
France	1957:1 - 1996:4	0.11	0.04	-0.02	-0.07	-0.13	-0.23	-0.34	-0.41	-0.40	-0.33	-0.20
Germany	1957:1 - 1997:1	0.06	-0.04	-0.15	-0.21	-0.31	-0.42	-0.45	-0.50	-0.55	-0.54	-0.48
Greece	1960:1 - 1996:4	0.23	0.20	0.10	0.05	-0.09	-0.22	-0.34	-0.38	-0.43	-0.41	-0.38
Italy	1962:1 - 1993:4	0.13	0.15	0.11	0.00	-0.15	-0.30	-0.45	-0.55	-0.57	-0.50	-0.41
Japan	1957:1 - 1997:1	0.25	0.21	0.12	0.01	-0.11	-0.27	-0.44	-0.57	-0.63	-0.63	-0.52
Netherlands	1957:1 - 1997:2	-0.10	-0.05	-0.04	-0.09	-0.18	-0.26	-0.29	-0.31	-0.28	-0.23	-0.20
Spain	1961:1 - 1997:1	0.06	0.05	0.03	0.01	-0.06	-0.09	-0.03	-0.06	-0.03	-0.07	-0.10
Sweden	1960:1 - 1997:1	0.24	0.16	0.05	-0.06	-0.25	-0.40	-0.49	-0.53	-0.53	-0.52	-0.44
Switzerland	1963:1 - 1997:1	0.15	0.07	-0.01	-0.08	-0.16	-0.26	-0.32	-0.33	-0.34	-0.38	-0.40
U.K.	1957:1 - 1997:1	0.02	-0.06	-0.20	-0.34	-0.45	-0.53	-0.58	-0.58	-0.49	-0.32	-0.15
U.S.	1957:1 - 1997:1	0.29	0.16	-0.00	-0.17	-0.35	-0.52	-0.63	-0.68	-0.66	-0.59	-0.49

NOTE: p denotes logarithm of the price level and y the logarithm of industrial production.

TABLE 2
Hodrick-Prescott Cyclical Correlations Of Money With Industrial Production

Correlation Coefficients, $\rho(m_t, y_{t+j}), j = -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5$

Country	Sample Period	$j=-5$	$j=-4$	$j=-3$	$j=-2$	$j=-1$	$j=0$	$j=1$	$j=2$	$j=3$	$j=4$	$j=5$
Austria	1957:1 - 1995:4	-0.41	0.12	-0.31	0.24	-0.43	0.12	-0.28	0.31	-0.32	0.24	-0.11
Australia	1957:3 - 1997:1	-0.14	-0.10	-0.00	0.12	0.24	0.39	0.50	0.47	0.36	0.15	-0.00
Belgium	1957:1 - 1996:4	-0.07	-0.16	-0.21	-0.24	-0.13	-0.09	-0.00	0.06	0.14	0.17	0.14
Canada	1957:1 - 1997:1	0.11	0.07	0.04	0.07	0.10	0.15	0.25	0.31	0.31	0.25	0.21
Finland	1957:1 - 1997:1	-0.02	-0.08	-0.15	-0.18	-0.23	-0.27	-0.25	-0.17	-0.01	-0.03	0.00
France	1957:1 - 1996:4	0.07	0.00	-0.02	0.00	0.12	0.13	0.26	0.21	0.20	0.07	0.02
Germany	1957:1 - 1997:1	-0.02	-0.01	-0.04	-0.06	0.02	0.12	0.17	0.22	0.26	0.26	0.21
Greece	1960:1 - 1996:4	0.03	0.21	0.11	0.03	0.03	0.05	-0.03	-0.06	-0.09	0.03	-0.01
Italy	1962:1 - 1993:4	-0.16	-0.15	-0.13	-0.02	0.04	0.20	0.26	0.31	0.23	0.19	0.08
Japan	1957:1 - 1997:1	-0.02	-0.02	0.01	0.04	0.10	0.17	0.22	0.16	0.10	0.02	-0.06
Netherlands	1957:1 - 1997:2	-0.00	-0.07	-0.19	-0.22	-0.19	-0.10	-0.03	0.08	0.17	0.25	0.27
Spain	1961:1 - 1997:1	0.04	0.04	0.13	0.12	0.08	-0.00	-0.01	0.03	0.08	0.12	-0.01
Sweden	1960:1 - 1997:1	0.08	0.09	0.09	0.11	0.06	0.02	-0.02	-0.03	-0.05	-0.07	-0.11
Switzerland	1963:1 - 1997:1	-0.13	0.20	-0.25	0.08	-0.11	0.25	-0.13	0.27	0.14	0.49	0.05
U.K.	1957:1 - 1997:1	0.05	0.07	0.08	0.11	0.13	0.13	0.13	0.13	0.09	0.04	-0.03
U.S.	1957:1 - 1997:1	-0.00	-0.00	-0.03	0.02	0.04	0.10	0.16	0.24	0.23	0.19	0.11

NOTE: m denotes logarithm of the money stock and y the logarithm of industrial production.