

On the Autocorrelations of Changes in Output, Money, and Prices

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Abstract

This paper examines the autocorrelation behavior of the growth rates of real output per capita, money, and consumer prices in the sample of developed countries in the 1951-1990 period. Both over short and long horizons, the given variables tend to be positively autocorrelated.

JEL classification: E31, E32, E40

Keywords: Autocorrelations; Consumer prices; Money; Real output per capita

This brief study examines the serial correlations of the growth rates of real output per capita, the money stock, and consumer prices in the sample of 22 developed countries in the 1951-1990 period. The paper evaluates autocorrelation coefficients from the first to the sixth orders for each variable and each country. The average autocorrelation behavior is compared to the long-run autocorrelation pattern for the United States presented by Nelson and Plosser (1982).

The data for real output per capita are taken from the Summers-Heston data set, Mark 5.7 (see Summers and Heston, 1991, and the web site <http://pwt.econ.upenn.edu/>).

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The data for money and consumer prices are taken from the *International Financial Statistics Yearbook* of the International Monetary Fund.

Tables 1, 2, and 3 present autocorrelation coefficients for the growth rates of real output per capita, money, and consumer prices. These tables also present means, standard deviations, and t-statistics testing the significance of the difference of the means from zero. Table 4 shows autocorrelation coefficients from the Nelson and Plosser (1982) study.¹ Table 1 indicates that the growth rates of real output per capita are on average significantly positively autocorrelated over the period of one year. The corresponding average autocorrelation coefficient, r_1 , is lower than the autocorrelation coefficient r_1 for real GNP in Table 4. The average coefficients r_2 and r_3 in Table 1 are not significantly different from zero. Coefficient r_4 is marginally significantly positive, and coefficients r_5 and r_6 are significantly positive. Thus, an important difference from Nelson and Plosser's observation is that the growth of output (expressed in per capita terms in the present study) does not tend to be negatively autocorrelated over long horizons. Table 2 indicates that the growth of the money stock is on average positively autocorrelated both over short and long horizons. The average coefficients r_1 and r_2 in Table 2 are lower than the corresponding coefficients in Table 4. As opposed to the present finding, Table 4 shows some tendency for a weakly negative autocorrelation of the change in money over long horizons. Table 3 provides evidence for a strongly significantly positive average autocorrelation of the price level, both over short and long horizons. All the average autocorrelation coefficients are larger for consumer prices than for output or money. All the average autocorrelation coefficients in Table 3 are greater than the corresponding autocorrelation coefficients for consumer prices in Table 4. Table 4 indicates practically zero autocorrelations for consumer prices over the horizons exceeding two years. Table 3 presents a substantially more persistent behavior of inflation.

¹ The starting years in the study of Nelson and Plosser vary from 1860 to 1909 (the study also considers some other variables). All the series end in 1970.

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Table 1. Autocorrelation coefficients for changes in real output per capita in 1951-1990
(annual data).

	r_1	r_2	r_3	r_4	r_5	r_6
Australia	-0.07	-0.35	-0.30	0.32	0.42	-0.16
Austria	0.19	-0.07	0.21	0.19	0.27	0.44
Belgium	0.15	0.17	-0.03	0.19	-0.13	0.18
Canada	0.09	-0.20	0.11	0.00	-0.14	-0.16
Denmark	0.06	-0.15	0.14	0.01	0.07	-0.09
Finland	0.17	-0.43	-0.23	0.05	0.24	-0.13
France	0.40	0.19	0.29	0.30	0.28	0.30
Germany	0.46	0.11	0.19	0.37	0.29	0.09
Greece	0.18	0.29	0.30	0.22	0.13	0.23
Iceland	0.24	-0.28	-0.38	-0.24	0.00	-0.05
Ireland	0.37	0.03	-0.19	-0.02	-0.08	-0.16
Italy	0.19	0.03	0.11	0.06	-0.11	0.32
Japan	0.53	0.35	0.44	0.36	0.22	0.23
Netherlands	0.33	-0.19	-0.08	0.05	0.12	0.26
New Zealand	0.06	-0.17	-0.06	-0.25	0.10	0.04
Norway	0.36	0.05	-0.26	-0.22	-0.18	-0.11
Portugal	0.36	0.19	0.27	-0.14	-0.13	0.00
Spain	0.24	0.05	0.26	0.21	0.09	0.25
Sweden	0.30	-0.03	-0.05	0.19	0.48	0.17
Switzerland	0.20	-0.15	-0.08	-0.05	0.01	0.13
United Kingdom	0.11	-0.31	-0.21	-0.00	0.14	0.13
United States	-0.03	-0.13	-0.20	0.08	-0.02	-0.03
Mean	0.22	-0.05	0.01	0.08	0.09	0.09
Deviation	0.16	0.21	0.23	0.19	0.19	0.18
t-statistic	6.72	-1.01	0.23	1.91	2.36	2.22

Table 2. Autocorrelation coefficients for changes in the money stock in 1951-1990 (annual data).

	r_1	r_2	r_3	r_4	r_5	r_6
Australia	0.16	0.10	0.28	0.31	0.15	0.07
Austria	-0.21	0.02	0.25	-0.06	0.02	-0.17
Belgium	0.22	0.11	0.06	0.00	-0.02	-0.30
Canada	0.24	0.05	0.01	-0.09	-0.14	-0.07
Denmark	-0.05	0.13	0.35	0.04	0.05	0.12
Finland	-0.04	-0.09	0.26	0.16	-0.07	0.02
France	0.35	0.08	0.10	0.02	-0.14	-0.09
Germany	0.04	-0.10	0.33	0.06	-0.12	-0.00
Greece	-0.03	0.26	-0.15	0.18	-0.27	0.07
Iceland	0.44	0.41	0.61	0.47	0.24	0.42
Ireland	0.48	0.40	0.33	0.14	0.19	0.13
Italy	0.62	0.39	0.32	0.12	0.09	0.07
Japan	0.58	0.53	0.48	0.37	0.31	0.26
Netherlands	0.09	-0.01	0.23	-0.09	0.12	0.03
New Zealand	0.40	0.37	0.23	0.04	0.09	0.28
Norway	0.31	0.34	0.37	0.38	0.20	0.26
Portugal	0.45	0.28	0.13	0.12	0.20	0.45
Spain	0.47	0.11	-0.15	-0.08	-0.14	-0.18
Sweden	0.48	0.25	0.36	0.22	0.16	0.04
Switzerland	0.13	0.04	-0.27	0.06	0.02	-0.03
United Kingdom	0.51	0.42	0.33	0.45	0.48	0.26
United States	0.20	0.17	0.07	0.08	0.02	0.25
Mean	0.27	0.19	0.21	0.13	0.07	0.09
Deviation	0.23	0.18	0.21	0.17	0.17	0.19
t-statistic	5.36	5.04	4.53	3.61	1.76	2.10

Note: The periods are 1951-1989 for Germany, 1952-1990 for Iceland, 1954-1990 for Japan, 1951-1989 for Sweden, and 1952-1990 for the United Kingdom.

Table 3. Autocorrelation coefficients for changes in the price level in 1951-1990 (annual data).

	r_1	r_2	r_3	r_4	r_5	r_6
Australia	0.78	0.42	0.32	0.36	0.31	0.17
Austria	0.58	-0.07	0.04	-0.16	0.01	-0.10
Belgium	0.76	0.52	0.33	0.13	0.19	0.23
Canada	0.83	0.61	0.52	0.43	0.42	0.43
Denmark	0.71	0.45	0.39	0.42	0.34	0.32
Finland	0.55	0.25	0.06	-0.06	0.06	0.23
France	0.53	0.28	0.14	0.15	-0.05	0.06
Germany	0.70	0.31	0.14	0.05	0.01	0.03
Greece	0.82	0.69	0.64	0.59	0.59	0.57
Iceland	0.76	0.66	0.58	0.49	0.50	0.37
Ireland	0.85	0.62	0.45	0.40	0.40	0.33
Italy	0.84	0.71	0.63	0.48	0.37	0.29
Japan	0.58	0.35	0.32	0.07	-0.04	0.02
Netherlands	0.57	0.42	0.46	0.22	0.13	0.24
New Zealand	0.79	0.64	0.56	0.59	0.66	0.56
Norway	0.60	0.35	0.30	0.24	0.38	0.38
Portugal	0.88	0.80	0.73	0.65	0.64	0.58
Spain	0.80	0.63	0.44	0.27	0.16	0.11
Sweden	0.67	0.37	0.33	0.40	0.38	0.28
Switzerland	0.70	0.32	0.03	-0.12	-0.13	0.02
United Kingdom	0.79	0.58	0.46	0.46	0.43	0.24
United States	0.80	0.52	0.38	0.36	0.41	0.36
Mean	0.72	0.47	0.38	0.29	0.28	0.26
Deviation	0.11	0.20	0.20	0.23	0.23	0.19
t-statistic	30.88	11.17	8.79	5.88	5.64	6.52

Table 4. Long-run autocorrelation coefficients for the U.S. economy. Source: Nelson and Plosser (1982).

	r_1	r_2	r_3	r_4	r_5	r_6	s
Real GNP	0.34	0.04	-0.18	-0.23	-0.19	0.01	0.13
Money stock	0.62	0.30	0.13	-0.01	-0.07	-0.04	0.11
Consumer prices	0.58	0.16	0.02	-0.00	0.05	0.03	0.09

Notes: The coefficients are computed from the first differences of the natural logarithms of annual observations. s denotes a large sample standard error for r.