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FISHER EFFECTS AND CENTRAL BANK INDEPENDENCE

by

Kenneth M. Emery*

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Federal Reserve Bank of Dallas

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Introduction

Barsky (1987) shows that for a Fisher effect to be statistically observable, the rate of inflation must be persistent. This demonstration follows from the fact that if inflation follows a white-noise process, changes in ex post inflation represent random forecast errors that will be uncorrelated with expected inflation and nominal interest rates. Therefore, in this case, there need be no statistically significant relationship between inflation and nominal interest rates even if the Fisher relation holds ex ante. Klein (1975) makes a similar point by showing that, because inflation was relatively unpredictable during the 1880-1915 gold standard in the United States, there was only a weak ex post Fisher relation. Barthhold and Dougan (1986), Emery (1990), and Hutchison and Keeley (1989) show, using U.S. data, that the forecastability of inflation may indeed change over time and, in turn, change the observed relationship between nominal interest rates and inflation.

Because previous work has examined only U.S. data, this paper studies the behavior of inflation and nominal interest rates across countries to see what role the persistence of inflation has for the existence of Fisher effects.

A second goal of this paper is to examine whether the behavior of money growth, inflation, and interest rates in a given country is dependent on the institutional characteristics of the central bank in that country. This examination ties in with the recent work on the Fisher equation because, in this work, the existence of Fisher effects is hypothesized to depend on the monetary regime in place. Specifically, if the monetary authorities carry out policy in such a way as to make inflation relatively persistent, then Fisher effects are more likely to be observed. Economic literature on the positive theory of monetary policy suggests that monetary policies will differ depending on whether the policy-making agent is discretionary, democratically-elected and relatively short-lived, or whether the policy-making agent is autonomous, relatively long-lived and has reputation as an important consideration (see, for example, Gordon 1975, Kydland and Prescott 1977, Barro 1983, Barro and Gordon 1983a and 1983b, Backus and Driffill 1985). Bade and Parkin (1987) show that, for the 1972-86 period, there is a negative relationship between the degree of policy independence of a central bank and the rate of inflation that is observed for that country. Building on the work of Bade and Parkin, this paper further examines whether there is a relationship between central bank independence and inflation rates, paying particular attention to the dynamics of inflation and Fisher effects. Because the time-series properties of inflation hinge on those of money growth, I examine various statistics on inflation and money growth across nine OECD countries that have central banks with varying degrees of independence.

The first section of the paper reviews how the Fisher hypothesis has typically been tested and the problems that this testing methodology entails. The empirical work follows.

Measuring Fisher Effects

The equation typically employed to test the Fisher hypothesis can be expressed as

$$R_t = \alpha + \beta \pi^e_{t+1} + \epsilon_t \quad , \tag{1}$$

where R_t is the nominal interest rate at time t on bonds that mature at time t+1, ϵ_t is an error term, and α (the real interest rate) and β are to be estimated. The strong version of the Fisher hypothesis is that $\beta = 1$ so that a 1 percentage point rise in expected inflation causes nominal interest rates to rise by 1 percentage point.

If either lagged inflation or ex post inflation is used as a proxy for expected inflation, several problems arise in testing the Fisher equation using equation 1. First, as Barsky (1987) points out, if inflation follows a white-noise process, then using lagged inflation as a proxy for expected inflation would yield an estimated β coefficient close to zero even though Fisher's theory may hold one-for-one. If, however, inflation is very persistent, estimates of β will be larger and we are more likely to accept the strong version of the Fisher hypothesis.

Second, if ex post or realized inflation is used as a proxy for expected inflation, an errors-in-variables problem must be overcome. Errors in measuring expected inflation will bias the OLS estimate of β toward zero. The size of the bias is approximately equal to the error variance as a percentage of the variance of expected inflation. If inflation follows a white-noise process, all the variation in ex post inflation represents random forecast error, and an OLS estimate of β would equal zero even though the strong form of the Fisher hypothesis may be valid.

A further difficulty with using equation 1 is the assumption that the real interest rate is constant. Several studies (for example, Mishkin 1981, Makin 1983) indicate that real interest rates are not constant. Hutchison and Keeley (1989) note that if real interest rates are not constant, the estimate of β will be biased if the proxy for expected inflation is correlated with real interest rates.

The above criticisms make it clear that using equation 1 to test the Fisher hypothesis is hazardous. However, the criticisms of using equation 1 suggest that ex post Fisher effects should be observable when inflation is persistent. This is in contrast to other explanations of the lack of Fisher effects during certain periods, such as Friedman and Schwartz's (1982) argument that financial markets only gradually "learned their Fisher" or Summers' (1984) "irrationality" (or nonneutrality of inflation on real returns) argument.

Building on the above insights, Hutchison and Keeley (1989) show that the dynamics of inflation are linked to the dynamics of money growth. They do this by combining a Cagan (1956) money demand function with a simple autoregressive process for the money supply to show that expected inflation depends on expected money growth, which in turn depends on the persistence money growth.[1] Although this is not a novel result, they extend Barsky's (1987) work by pointing out that whether or not a Fisher effect is observed may depend on the dynamics of money growth as well as the dynamics of inflation. Hutchison and Keeley then show that the strongly observed ex post Fisher effects after 1961 coincide with an increase in the forecastability of

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[1] This is probably the simplest way of illustrating Barsky's (1987) argument that the existence of ex post Fisher effects is linked to the monetary regime in effect. Hutchison and Keeley (1989) also point out that real supply-side shocks may affect both expected inflation and real interest rates, thus biasing estimates of β. Additionally, real supply-side shocks may cause inflation to become autocorrelated, and thus forecastable, without money growth becoming any more forecastable.

money growth.[2]

Empirical Evidence

I examine interest rate, money growth, and inflation data for nine OECD countries. The data are from four countries that have central banks that can be classified as strong (Germany, Japan, Switzerland, and the United States) and five countries that have central banks that can be classified as weak (Australia, Canada, Denmark, Italy, and the United Kingdom). This classification is taken from a study by Bade and Parkin (1987), who examine the financial and institutional characteristics of different OECD central banks as they relate to their independence from the rest of the government. For the group of more independent central banks, the bank is the final policy authority. Within this group, German and Swiss central banks have more independence than either the U.S. or Japanese central banks because they are able to select board members without government approval. Among the group of countries with relatively less independent central banks, the final policy authority rests with the government, and the government appoints all board members. Australia has the least independence among this group of countries because its central bank has a government official on the board.

The data is quarterly for the period 1972Q1-1990Q2 and are from the International Financial Statistics.[3] The sample starts in 1972 because this

[2] Emery (1990) shows that after 1983 inflation appears to follow a white-noise process, and thus there is no observed ex post Fisher relationship after 1983.

[3] Seasonally adjusted money (line 34b) is used as the monetary variable. Seasonally adjusted money includes currency outside banks and demand deposits other than those of the government. The interest rate is a short-term Treasury bill rate (line 60c) where available or a short-term money market rate (line 60b). U.S. data are M1 for the monetary aggregate, the three-month

date coincides with the breakdown of the Bretton Woods system and the beginning of the floating exchange rate period in which countries became able to set independent monetary policies.

Inflation, Money Growth and Interest Rates

In this section, I examine inflation and money growth behavior to see whether there is any relationship between central bank independence and monetary policy. Table 1 presents the sample means and standard deviations of inflation and money growth for the nine countries. As can be seen from this table, the countries with more independent central banks have lower average inflation rates than countries with relatively weaker central banks. Only Switzerland and Germany, however, have average inflation rates that are greater than two standard deviations from the average inflation rate of 8.6 percent for the less independent central bank countries. Although there may be underlying reasons why these countries have independent central banks (that is, past history of hyperinflation periods and/or preferences for lower inflation rates), there exists, nevertheless, a positive relationship between independent central banks and relatively lower inflation rates.

Table 1 shows that there does not appear to be any strong relationship between central bank independence and the variability of inflation. While Germany, Switzerland, and the United States are ranked first, third, and fourth, respectively, Japan is ranked seventh among the nine countries under consideration. This suggests that monetary policy may not be any less variable in countries with independent central banks. Table 1 also indicates

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Treasury bill rate for the interest rate, and the log difference of the CPI for inflation, all obtained from Citibase. The use of M2, instead of M1, for the U.S monetary aggregate does not qualitatively affect the results.

that there does not appear to be any relationship between money growth variability and central bank independence.

Because most central banks use interest rates as their instruments of policy, it is possible that stable interest rates could be identified with stable monetary policy. Table 2 shows the standard deviations of short-term nominal interest rates across the nine countries for the 1972-90 sample. Of the five countries with the lowest standard deviations, four have independent central banks (the United Kingdom is the exception). There are several obvious problems, however, with this measure of policy stability. First, the Fisher equation states that nominal interest rates should vary to reflect changes in inflation expectations. If central banks are unwilling to allow interest rates to move with changes in inflation expectations, this suggests that policy is contributing to instability rather than stability. Examining real interest rates avoids this problem, but there are many factors that contribute to movements in real interest rates. All of this suggests that because central banks manipulate interest rates with a view toward controlling particular monetary aggregates, which in turn determine inflation, there is no inconsistency in using the variability of inflation as an indicator of the stability of policy. Still, the weak inverse relationship between countries with stronger independent central banks and short-term interest rate variability is interesting.

Table 3 shows the results of estimating simple first-order autoregressive processes for inflation and money growth. This estimation is carried out to examine whether there is any relationship between central bank independence and the dynamics of inflation and money growth. The results of the examination are also used to see whether the existence of Fisher effects is dependent on the persistence of inflation, as Barsky first suggested.

The results in Table 3 indicate that there does not appear to be any relationship between central bank independence and inflation or money growth persistence. While Germany is ranked first with the largest autoregressive coefficient, Switzerland has the least autoregressive money growth process of all nine countries. The inflation process estimates yield a similar conclusion. There does not appear to be any relationship between central bank independence and the degree of autocorrelation in the inflation process.

An interesting result that does stand out, though, is the similarities in rankings, and to a lesser degree the magnitude of the autoregressive coefficient themselves, for money growth and inflation processes in a given country. Although there is no evidence on causation here, the results provide further evidence that money growth and inflation are closely linked.

In Table 4, Ljung-Box statistics are presented that test the null hypothesis of no autocorrelation (that is, white noise) after eight lags. This provides further evidence on the degree of persistence in the inflation and money growth processes for the nine countries. For inflation, the null hypothesis is rejected for all nine countries. In ranking the magnitude of the Ljung-Box statistics, we can get an idea of how far away from white noise the different countries' inflation processes are. The rankings of the Ljung-Box statistics give approximately the same rankings as did the AR(1) estimation of the different inflation series. The only exception is the Netherlands, which ranked seventh in terms of the size of the first-order autoregressive coefficient on inflation but ranked first in terms of being furthest away from white noise as given by the Ljun-Box statistic.

The country rankings on the Ljung-Box statistics for money growth match relatively similarly the rankings for the AR(1) coefficients on money growth. As evidenced by both the size of the AR(1) coefficients and the Ljung-Box statistics, money growth has much less persistence than inflation. In fact, for the Netherlands and Switzerland, white noise cannot be rejected at a .05 level of significance.

Ex Post Fisher Effects

Table 5 presents the estimates of equation 1 that yield Fisher effects as measured by the estimates of β. Again, there does not appear to be any relationship between central bank independence and the observance of Fisher effects. Germany yields the highest estimate of β equal to .38 so that a 1 percentage point increase in the inflation rate results in a .38 percent increase in the short-term nominal interest rate. Switzerland, on the other hand, yields a statistically insignificant negative estimate of β.

The results, however, support Barsky's (1987) persistence of inflation explanation for why we may or may not observe Fisher effects. The second and third columns of Table 5 give the rankings of inflation and money growth persistence copied from Table 3. It is clear that there is a high degree of correlation between Fisher effects and the persistence of inflation and money growth for a given country.

Conclusions

Because of the problems stated above in using estimates from equation 1 to test the Fisher hypothesis, the results in Table 5 do not constitute a test of the Fisher hypothesis. Instead, the results provide further support for

Barsky's (1987) contention that the monetary regime in place, specifically the inflation process that this regime yields, will be of primary importance in determining whether or not Fisher effects are observed. This is in contrast to explanations by other authors (Friedman and Schwartz 1982, Summers 1984).

The results in this paper are also consistent with Hutchison and Keeley's (1989) observation that, because the dynamics of money growth affect the dynamics of inflation, we should expect to observe Fisher effects when money growth is persistent and forecastable.

Additionally, the results here confirm Bade and Parkin's (1987) findings that more independent central banks yield lower average inflation rates but do not appear to influence the variability of inflation, a reasonable measure of policy stability. The results in this paper also show that, for a given country, the dynamics of inflation and money growth do not appear to be affected by the degree of central bank independence. Therefore, although the observance of Fisher effects depends on the monetary regime in place, central bank independence does not appear to be one of the relevant factors for whether or not Fisher effects are observed.

Table 1

	Inflation Statistics		Money Growth Statistics	
	Mean	Std. Dev.	Mean	Std. Dev.
Germany	3.69 (1)	2.88 (1)	7.3 (2)	5.8 (3)
Switzerland ---	3.86 (2)	3.73 (4)	10.0 (6)	10.8 (8)
Japan	5.47 (4)	6.80 (7)	8.6 (4)	9.0 (7)
United States ---	6.45 (5)	3.63 (3)	7.0 (1)	4.4 (2)
United Kingdom	9.92 (8)	7.63 (9)	13.5 (8)	7.9 (5)
Netherlands	4.65 (3)	3.99 (5)	7.7 (3)	8.9 (6)
Canada	7.12 (6)	3.44 (2)	9.7 (5)	1.0 (1)
Italy ---	12.18 (9)	6.80 (8)	14.3 (9)	7.5 (4)
Australia	9.24 (7)	4.78 (6)	12.3 (7)	11.6 (9)

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rankings in parentheses

annual rates

Table 2

Nominal Interest Rate Variability

	Std. Dev.	
Germany	2.55	(2)
Switzerland	1.90	(1)

Japan	2.66	(5)
United States	2.65	(4)

United Kingdom	2.59	(3)
Netherlands	2.90	(6)
Canada	3.30	(7)
Italy	4.15	(9)

Australia	3.90	(8)

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rank in parentheses

Table 3

AR(1) Estimation of Inflation and Money Growth

	Money Growth				Inflation			
	Const.	ρ	R^2		Const.	ρ	R^2	
Germany	.032	.541	.29	(1)	1.45	.583	.34	(4)
	(.009)	(.100)			(.449)	(.095)		
Switzerland	.080	.231	.00	(9)	2.06	.447	.19	(8)
	(.023)	(.219)			(.572)	(.106)		
Japan	.053	.377	.13	(5)	2.36	.569	.31	(5)
	(.014)	(.113)			(.857)	(.098)		
United States	.038	.544	.28	(2)	1.39	.788	.62	(1)
	(.010)	(.103)			(.541)	(.073)		
United Kingdom	.092	.315	.09	(7)	4.47	.548	.28	(6)
	(.018)	(.114)			(1.27)	(.101)		
Netherlands	.053	.283	.07	(8)	2.03	.542	.28	(7)
	(.013)	(.112)			(.613)	(.100)		
Canada	.047	.502	.24	(3)	1.54	.777	.57	(2)
	(.015)	(.105)			(.634)	(.080)		
Italy	.069	.507	.24	(4)	3.34	.723	.50	(3)
	(.017)	(.104)			(1.19)	(.085)		
Australia	.079	.345	.11	(6)	6.06	.347	.10	(9)
	(.019)	(.114)			(1.19)	(.114)		

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standard errors in parentheses

rankings in parentheses

Table 4

Ljung-Box Statistics after 8 lags

	Inflation	Money Growth
Germany	127.5 (5)	37.4 (3)
Switzerland	60.4 (8)	3.0* (9)

Japan	117.8 (6)	22.3 (5)
United States	165.0 (2)	33.2 (4)

United KIngdom	87.6 (7)	17.3 (6)
Netherlands	210.4 (1)	12.5* (8)
Canada	161.7 (3)	42.2 (2)
Italy	137.5 (4)	47.2 (1)

Australia	28.4 (9)	16.8 (7)
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* null hypothesis of no autocorrelation cannot be rejected at .05 signifi. level

rankings in parentheses

Table 5

Ex Post Fisher Effects

		Rk.	Infl. Auto. Rk.	Money Growth Auto. Rk.
Germany	.38 (.10)	(1)	(4)	(1)
Switzerland	-.05 (.09)	(9)	(8)	(9)

Japan	.23 (.04)	(4)	(5)	(5)
United States	.32 (.08)	(2)	(1)	(2)

United Kingdom	.06 (.04)	(6)	(6)	(8)
Netherlands	.06 (.09)	(7)	(7)	(7)
Canada	.20 (.11)	(5)	(2)	(4)
Italy	.26 (.07)	(3)	(3)	(3)

Australia	-.04 (.10)	(8)	(9)	(6)

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