Philip Viges
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The Fisher Hypothesis and Monetary Policy as an Inflation-Control Tool: An International Empirical Analysis

Abstract:

In this paper, I test the Fisher hypothesis that would suggest a one-for-one comovement between central banks' nominal interest rates and their expected values for the inflation rate. This research tests the Fisher hypothesis with updated data for the 1990s and 2000s in the United States, the United Kingdom, Japan, and the European Union. Additionally, I hypothesize that even in the event that long-term data does not bear out the Fisher hypothesis, regressions on particular periods known to exhibit extremely high or extremely low inflation tendencies will show that the Fisher hypothesis is more likely to govern the data when inflation is high. The 1970s in the West and Japan is a salient example, and I will be testing the previous hypothesis with different historical periods in the aforementioned countries. By way of a robustness check, I attempt to give a glimpse into the future of this sort of research by regressing the Federal Funds Rate against the 5-year TIPS spreads from 2004-2011. Here I intend to illustrate how TIPS spreads, an alternative expected inflation measure to *ex post* inflation numbers, and foreign counterparts may be used in the future to answer these questions about short-term Central Bank rates and inflationary expectations. I reject both hypotheses (the general Fisher hypothesis and the hypothesis that the Fisher effect holds in high-inflation environments) at the 5% confidence level. More advanced econometric methods I plan to use in the future may allow me to accept these as valid. The paper follows with proposed plausible explanations for both the phenomena that are not observed as well as for those that are illuminated by the data.

1. Introduction

Does monetary growth affect the real macroeconomy? The interpretation of classical theory is that it does not. Simplistically, as monetary growth occurs, consumers experience a nominal wealth effect that increases their ability to purchase goods and services, while producers in the economy see an opportunity to raise prices to capture greater real profits. Borrowers are much more willing to get loans and invest in capital or consumption goods, since they see monetary growth that will ease the repayment of any loan or bond. However, to protect their own future consumption, lenders will thus also revise their demanded return on investment upward. This will lead to higher nominal interest rates and higher price levels, but there will be the same amount of real consumption and investment in the economy. This basic theory is that of *monetary neutrality*, and it is what forms the underlying economic theory behind the Fisher Effect.

Using these assumptions, Irving Fisher in the 1920s proposes a simple model equation: $i = r + \pi^e$, where i is the nominal interest rate (the rate set by the bank), r is the real interest rate at which money can be lent and borrowed to anyone in the simplest macroeconomic models, and π^e is the expected rate of inflation. Fisher was able to empirically test and observe this relationship in the United States in the early 20th century. His model is known as the "Fisher equation" or, in a broader context, the "Fisher hypothesis." It relies on monetary neutrality to account for only changes in the price level and in the nominal interest rate, while real national income is not affected. Real interest rates are assumed constant over long periods of time. This is due to the fact that real interest rates reflect how economic agents discount the future. For example, if I am willing to lend you $1 if I get paid back $1.10 in one year, I discount one year from now at 10%. Rational expectations-based economic theory demands that future discounting remains constant over the long term, and that the equilibrium market real interest rate will reflect the level of discounting exhibited by borrowers and lenders. Thus, given a constant real interest rate, and monetary neutrality, one can surmise that nominal interest rates will move one-for-one with the expected rate of inflation so that lenders protect their real discounting.

For decades, central banks around the world have been attempting to control inflation, the general rise in price of goods and services over time. Their chief policy tool is setting short-term interest rates by adjusting the money supply through bond market operations, following the monetary theory of Milton Friedman. This serves to regulate inflation by limiting the amount of money overall in the economy; this low supply directly translates to a higher borrowing cost of money, i.e. the interest rate. In addition, the less money there is in the economy, the less total demand there is for goods and services, leading to a downward market pressure on the overall price level.

Many economists attempt to predict what central banks will do in response to inflation threats, as changes in the interest rate set by the central bank directly affect the trade of securities as well as goods and services in the short term. Fisher’s equation can be used profitably here. Fisher’s logic is as follows: given a hypothetical constant real interest rate over time, any changes in the observed (nominal) interest rates can be explained by the central bank’s expectations of future inflation; if the inflation forecast is high, the bank will move to raise rates and restrict the money supply, and vice versa. It is important to note that the Fisher effect is a long-term effect, assuming a constant long-term interest rate. Given short-term nominal rates, however, one can observe how these move with expected inflation, if they do at all.

This paper tests the Fisher hypothesis using central bank interest rates and inflation rates for four countries in the post-World War II period. This paper also empirically tests a second hypothesis: whether the Fisher effect is more pronounced in higher inflation environments. The test used will be a simple bivariate regression: $i = \beta_0 + \beta_1 * \pi^e$, with hypothesis tests

$H_0 : \beta_1 = 0$ $\quad$ $H_0 : \beta_1 = 1$
$H_1 : \beta_1 \neq 0$ $\quad$ $H_1 : \beta_1 \neq 1$, where $\alpha = 0.05$ is the significance level at which I reject
$\alpha = 0.05$ $\quad$ $\alpha = 0.05$

either null hypothesis. That is to say, if the regression model provides beta-one values that are less than 5% likely to occur in all possible times that I run this test given that the null hypotheses are true, I then reject the null hypotheses. The first test's null hypothesis assumes that there is no effect whatsoever on nominal short-term interest rates given a change in expected inflation. This of course must be rejected if the Fisher hypothesis is to hold. The second test's null hypothesis is precisely the Fisher hypothesis, which would suggest that there is a one-for-one comovement between the nominal interest rate and the expected inflation rate. Using data from Japan, the United States, Great Britain, and the Euro zone, I test this hypothesis controlling for historical periods of high and low inflation. The second null hypothesis above is that the coefficient on expected inflation will approach unity more closely in relatively higher inflation environments than in lower inflation environments. This is to account for recent problems that have been observed in the classic Fisher hypothesis in extremely low inflation environments, as the data demonstrate in Japan's "Lost Decade" in a following section of this paper.

2. Research Basis

The theoretical background for this paper is based on the work of Irving Fisher and the American economist, John Taylor. In "Discretion Versus Policy Rules in Practice" (1993) John Taylor initially proposes a simple mathematical formula for ex ante predictions of short-term interest rates based on central bank policy on the target unemployment rate and inflation. The fact that interest rates could be so simply tied to inflation, in theory, over time is the inspiration for this research, and suggests that one should be able to observe, given that the central bank has accurate knowledge of its inflation target, current inflation conditions, and a reasonable expectation of future inflation, the above correlation between changes in interest rates and changes in inflation. Alvarez, et al. in their research for the Federal Reserve Bank of Minneapolis, use the Taylor Rules to develop this theory in 2001.

John Cochrane's "Inflation Determination With Taylor Rules: A Critical Review" takes a contrary viewpoint, that in new-Keynesian models of dynamic expectation in inflation and interest rate policy, "Inflation determination requires ingredients beyond an interest-rate policy that follows the Taylor principle" (Cochrane, 2007). A simple one-for-one correlation between nominal interest rates and expected inflation may be too simplistic for new models of this relationship that are currently being developed.

Matti Viren of Finland performs a time-series study of inflation and short-term interest rates from 1972 to 1984 in 6 countries, including the United States, to test the Fisher hypothesis that "real rates of interest are constant over time and that movements in nomial [sic] rates can be explained by inflation only." (Viren, 1987) The analysis indicates that the time-series structures of nominal interest rates and inflation are very different and so "cannot be explained by inflation, or at least by inflation alone" (Viren, 1987). This analysis replicates the results of the Viren study using new data while attempting to determine in which inflation environments the Fisher relationship appears to truly govern.

Another thesis related to the empirical side of this topic is "Forecasting Inflation Using Interest-Rate and Time-Series Models: Some International Evidence" by R.W. Hafer and Scott Hein. They compare the use of interest rates and simple time-series prediction as effective inflation forecasts for six countries using the CPI. However, the analysis of this study uses current inflation as a proxy measure of expected inflation under the Rational Expectations Hypothesis. Note: Much work has therefore already been done to test whether the simple Fisher relationship holds in general. In most cases it fails, with the notable exception of the United States. The tests in this paper will attempt to replicate these prior results with updated data and also to determine how, if at all, the Fisher correlation does in fact hold. The second hypothesis is derived from an understanding that interest rates cannot go below 0: we would expect to see lower correlations and slope coefficients between expected inflation and nominal interest rates in very low inflation periods as opposed to higher inflation periods, where central banks are more able to respond with setting interest rates.

3. Methodology

As mentioned above, this paper uses current inflation data as a proxy variable for expected inflation, running the simple regressions mentioned above. Controlling for particular time frames in the United States and Japan, I use particular historical periods where one can reasonably assume a constant real long-term interest rate to account for variations in the real interest rate over the medium-to-long term. I explain why that assumption is in fact reasonable in those sections. In Great Britain, the analysis focuses on whether the Fisher hypothesis governs in a 10% or greater inflation rate environment as well as in a less than 10% inflation rate environment, due to patterns in the data to be demonstrated. Finally, I analyze the European Union data (only from the institution of the common Euro) only over approximately the first decade of the Euro's existence, since there are no prolonged periods of very high or very low inflation as there are in Japan, the U.K., and the United States. All data end in June 2008, prior to the most recent financial crisis, since data are still coming in from this present global contraction and theory needs to be developed on the effects of global central bank actions on inflation and interest rates. In all studies, I use a regular OLS regression followed by a White heteroskedasticity-adjusted regression, since one may suspect a change in the variance of the central bank rate given various inflation levels (i.e. an extremely low inflation environment would suggest very low interest rates, but these are bounded below by 0).

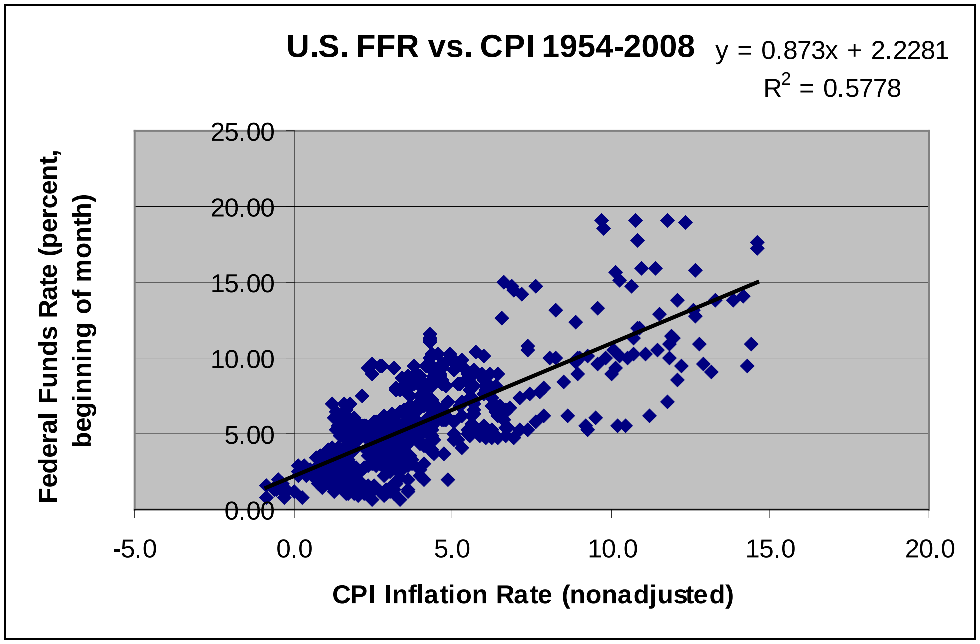
4. Analysis:

4.1. United States of America:
The U.S.A. time period being studied is July 1954 to June 2008.

The inflation data are drawn from the Federal Reserve Bank of St. Louis' FRED online database. The inflation measure used is standard CPI, monthly percent change from the previous year. Effective Federal Funds Rate data are drawn from the same source.

TABLE 1: UNITED STATES	United States Federal Funds Rate vs. CPI inflation rate July 1954-June 2008	United States FFR vs. CPI inflation rate July 1954-December 1972	United States FFR vs. CPI inflation rate January 1973-July 1979	United States FFR vs. CPI inflation rate August 1979-August 1987	United States FFR vs. CPI inflation September 1987-April 2006
Number of Observations	651	222	79	97	224
OLS Slope Coefficient Estimate	**0.8729469**	**0.8663554**	**0.6650286**	**0.6651686**	**1.333803**
OLS t-statistic	29.87	20.11	7.3	11.48	12.86
OLS p-value	0	0	0	0	0
OLS standard error	0.0292203	0.043071	0.0910551	0.057927	0.1037231
OLS 95% Confidence Interval	**.8155691** **.9303246**	**.7814709** **.95124**	**.4837148** **.8463425**	**.550169** **.7801683**	**1.129395** **1.538211**
White t-statistic	21.86	18.53	7.14	8.91	12.74
White p-value	0	0	0	0	0
White standard error	0.0399329	0.0467666	0.0931219	0.074681	0.1046818
White 95% Confidence Interval	**.7945336** **.9513601**	**.7741877** **.9585232**	**.4795993** **.8504579**	**.516908** **.8134292**	**1.127505** **1.5401**
R-squared	0.579	0.6478	0.4092	0.5812	0.4269

Bold numbers indicate statistically significant slope coefficients and respective confidence intervals under a hypothesis of $\beta 1=0$, while *italicized* numbers indicate not statistically significant under this hypothesis. Underlined numbers indicate statistically significant slope coefficients and respective confidence intervals under a hypothesis of $\beta 1=1$.



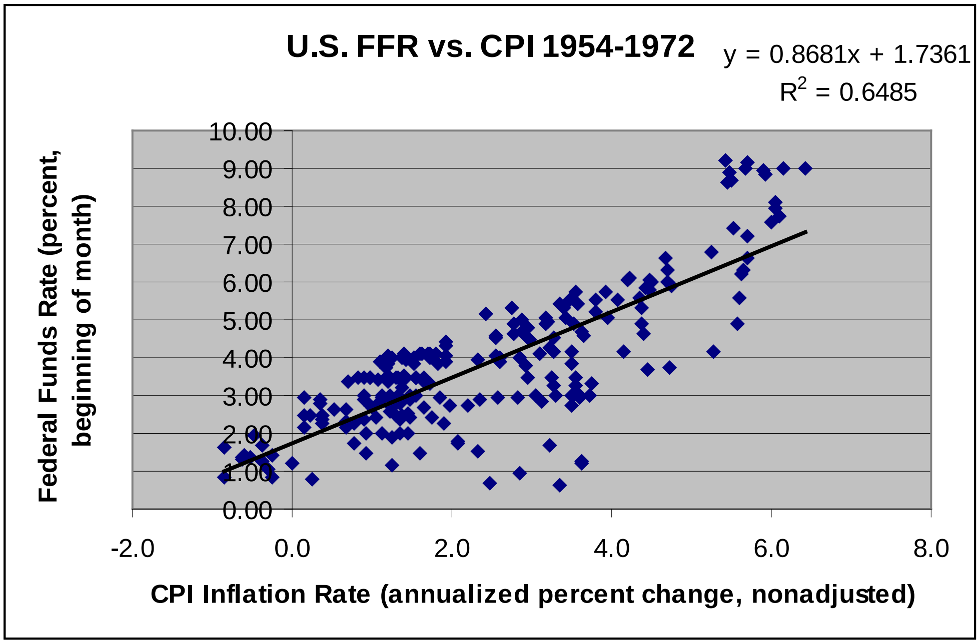
The estimated slope coefficient on inflation is about 0.87. The hypothesis that $\beta_1 = 1$ is rejected at a 0.05 significance level, even correcting for very likely heteroskedasticity. However, one can observe a slight bend to the data: a seemingly decreasing positive correlation as expected inflation (current inflation) rises.

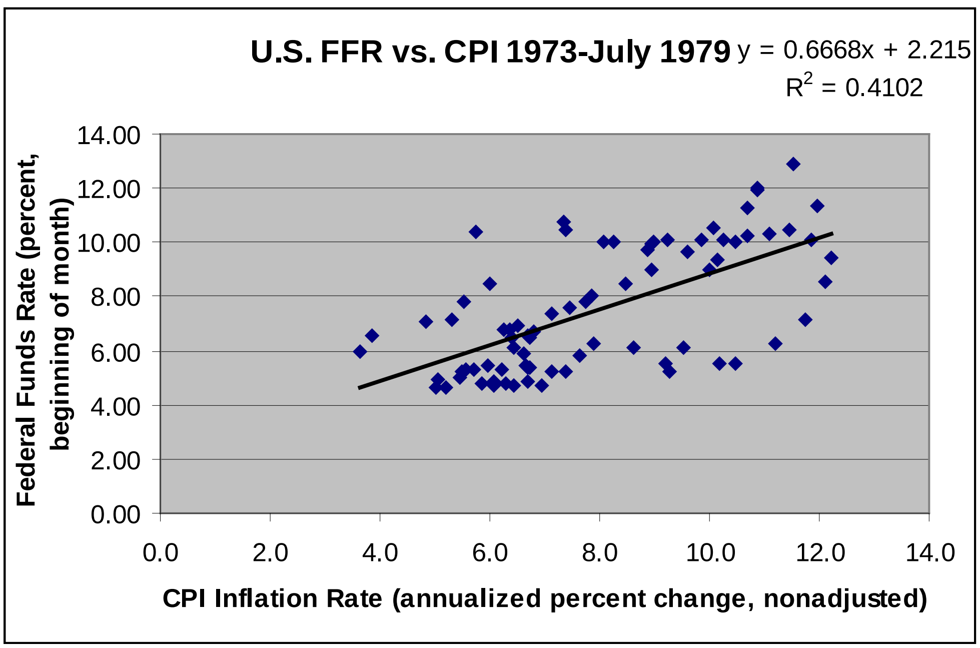
I now turn to the U.S. data divided up into 4 crucial historical periods for Federal Reserve monetary policy: July 1954-Dec 1972, the postwar-pre-oil crisis period; the pre-Volcker 1973-Aug 1979 period; the term of Federal Reserve Chairman Paul Volcker (Aug 1979-Aug 1987); and that of Alan Greenspan (Sept 1987-Apr 2006). The former two periods had a Keynesian monetary philosophy, which sought to combat unemployment through higher inflation, while Volcker and Greenspan saw relatively low inflation through the 1980s and 1990s despite their own differing philosophies. The first period was one of high productivity and high growth. The second period saw productivity shocks and uncertain economic times, perhaps revising people's discounting upward as they were more uncertain about the future in the long term. By the third period, long term inflation expectations may have become built into the long-term real interest rate itself, independent of short-term fluctuations. These expectations were disengaged from the baseline long-term real rate over the 1980s and into the 1990s, where another productivity increase occurred and the macroeconomy of the U.S. stabilized. Controlling for higher and lower inflation environments as demonstrated by the differing estimates for the real interest rate (the constant term in the regression, all of which were significant at a 0.05 level), we observe the following (cf. Table 1 for hypothesis tests[1]):

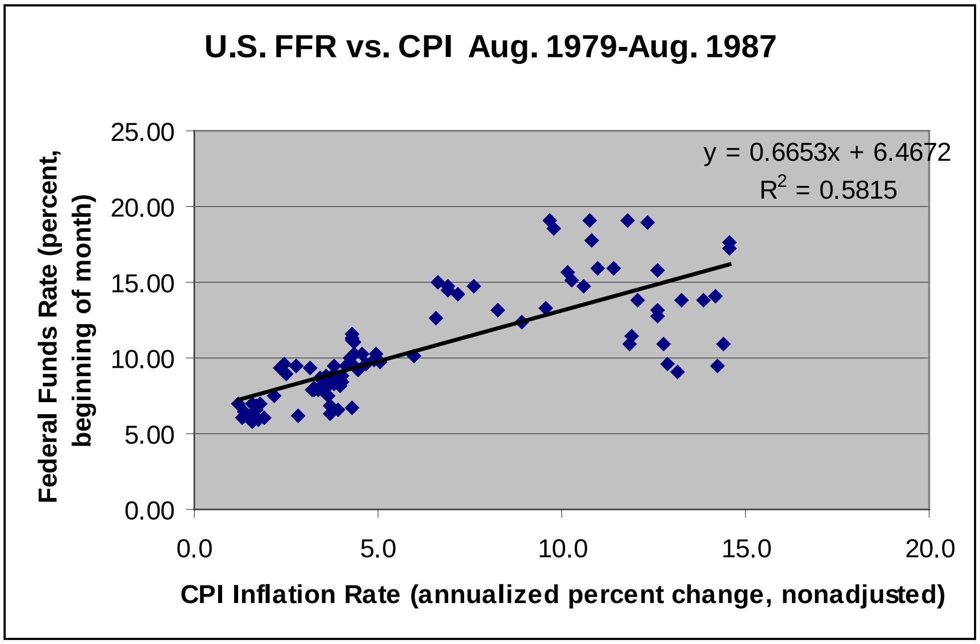
TABLE 1: UNITED STATES	United States Federal Funds Rate vs. CPI inflation rate July 1954-June 2008	United States FFR vs. CPI inflation rate July 1954-December 1972	United States FFR vs. CPI inflation rate January 1973-July 1979	United States FFR vs. CPI inflation rate August 1979-August 1987	United States FFR vs. CPI inflation September 1987-April 2006
Number of Observations	651	222	79	97	224
OLS Slope Coefficient Estimate	**0.8729469**	**0.8663554**	**0.6650286**	**0.6651686**	**1.333803**
OLS t-statistic	29.87	20.11	7.3	11.48	12.86
OLS p-value	0	0	0	0	0
OLS standard error	0.0292203	0.043071	0.0910551	0.057927	0.1037231
OLS 95% Confidence Interval	**.8155691 .9303246**	**.7814709 .95124**	**.4837148 .8463425**	**.550169 .7801683**	**1.129395 1.538211**
White t-statistic	21.86	18.53	7.14	8.91	12.74
White p-value	0	0	0	0	0
White standard error	0.0399329	0.0467666	0.0931219	0.074681	0.1046818
White 95% Confidence Interval	**.7945336 .9513601**	**.7741877 .9585232**	**.4795993 .8504579**	**.516908 .8134292**	**1.127505 1.5401**
R-squared	0.579	0.6478	0.4092	0.5812	0.4269

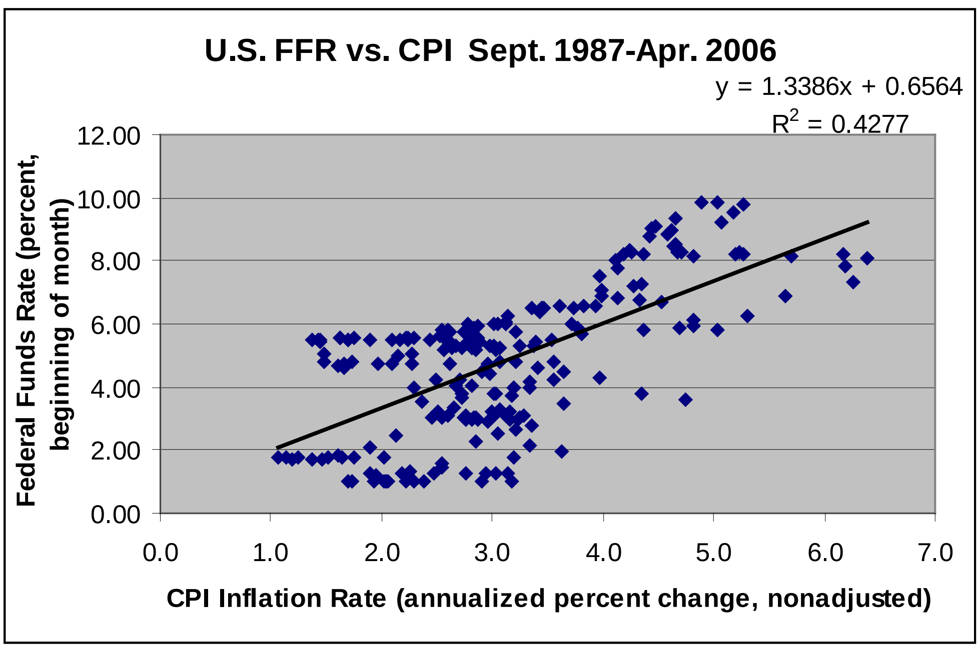
Bold numbers indicate statistically significant slope coefficients and respective confidence intervals under a hypothesis of $\beta1=0$, while *italicized* numbers indicate not statistically significant under this hypothesis. Underlined numbers indicate statistically significant slope coefficients and respective confidence intervals under a hypothesis of $\beta1=1$.

1. All Tables are repeated on pages 21-23 following the Works Cited.









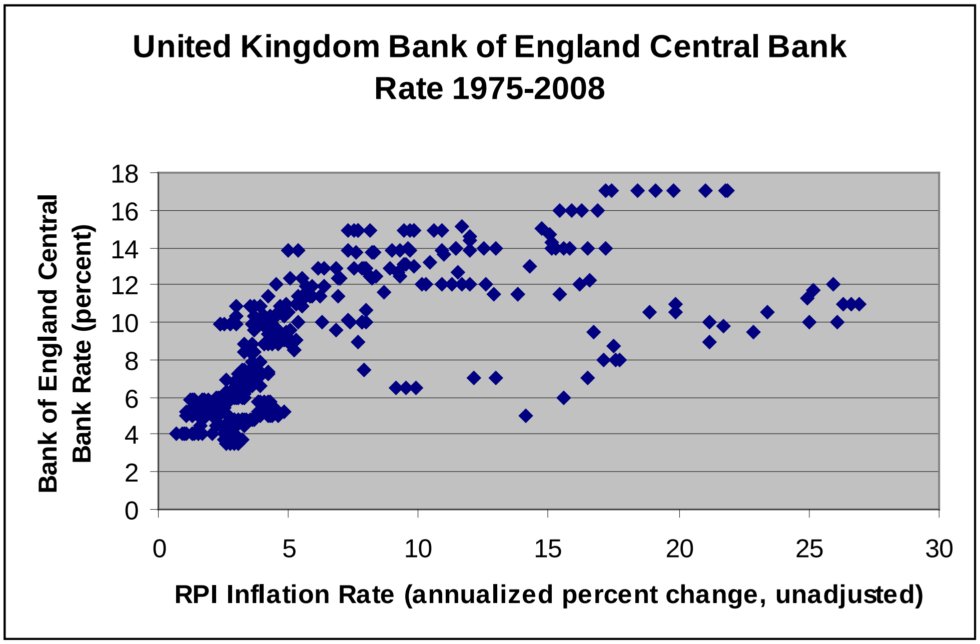
These regressions indicate that the general Fisher hypothesis fails to hold in each of these time periods at a 0.05 significance level. In addition, there does not appear to be a pattern between the historical time frames vis-à-vis any relationship between the estimates for the coefficient on the inflation rate regressor and the time periods. The pre-Volcker and Volcker eras actually yield virtually the same slope coefficient for the model, and the low-inflation, low-rate Greenspan era estimate in fact exceeds unity, yielding a Fisher coefficient that is statistically significant from 1 and too high. The logarithmic phenomenon, an apparently decreasing slope of the data as inflation increases appears to exhibit itself once again in the Volcker era (and the Greenspan era, to some extent). This logarithmic phenomenon will persist in Britain and Japan.

4.2 United Kingdom:

United Kingdom end of month official Bank Rate data come from the Bank of England's online database and Retail Prices Index inflation data from the British Office for National Statistics database. The data cover the time frame from January 1975 to June 2008.

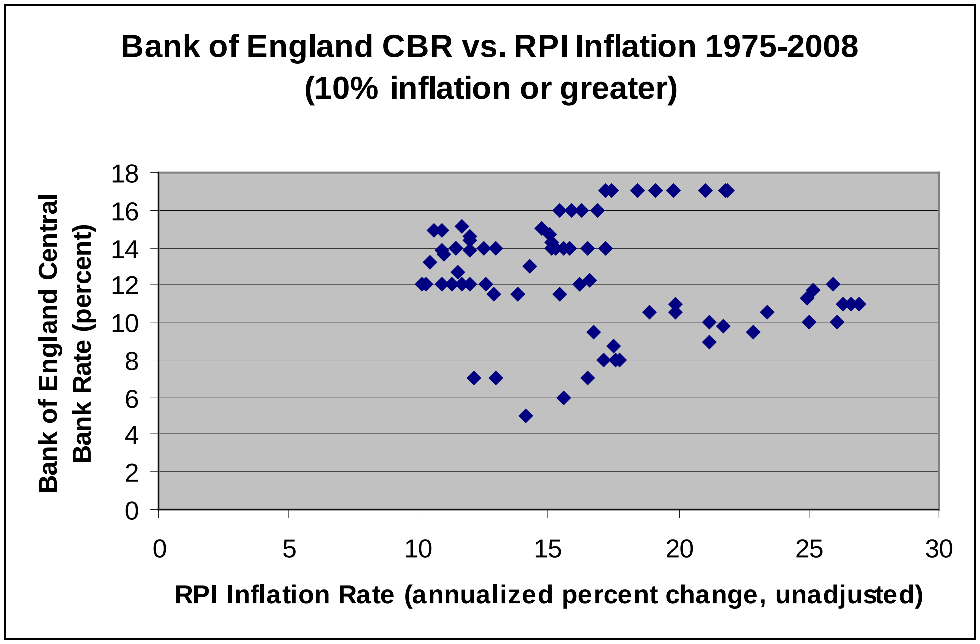
TABLE 2: UNITED KINGDOM	United Kingdom Bank of England Central Bank Rate vs. RPI inflation rate January 1975-June 2008	United Kingdom CBR vs. RPI inflation rate January 1975-June 2008; RPI inflation rate greater than or equal to 10%	United Kingdom CBR vs. RPI inflation rate January 1975-June 2008; RPI inflation rate less than 10%
Number of Observations	395	same; used dummy variable to indicate high or low inflation	
OLS Slope Coefficient Estimate	**0.4105017**	**0.6793586**	**1.474288**
OLS t-statistic	16.31	44.33	38.18
OLS p-value	0	0	0
OLS standard error	0.0251654	0.0153243	0.0386113
OLS 95% Confidence Interval	**.3610261** **.4599773**	**.6492308** **.7094865**	**1.398378** **1.550199**
White t-statistic	11.29	19.85	28.97
White p-value	0	0	0
White standard error	0.0363608	0.034217	0.0508934
White 95% Confidence Interval	**.3390156** **.4819878**	**.6120874** **.7466299**	**1.374231** **1.574346**
R-squared	0.4037	0.8334	0.7877

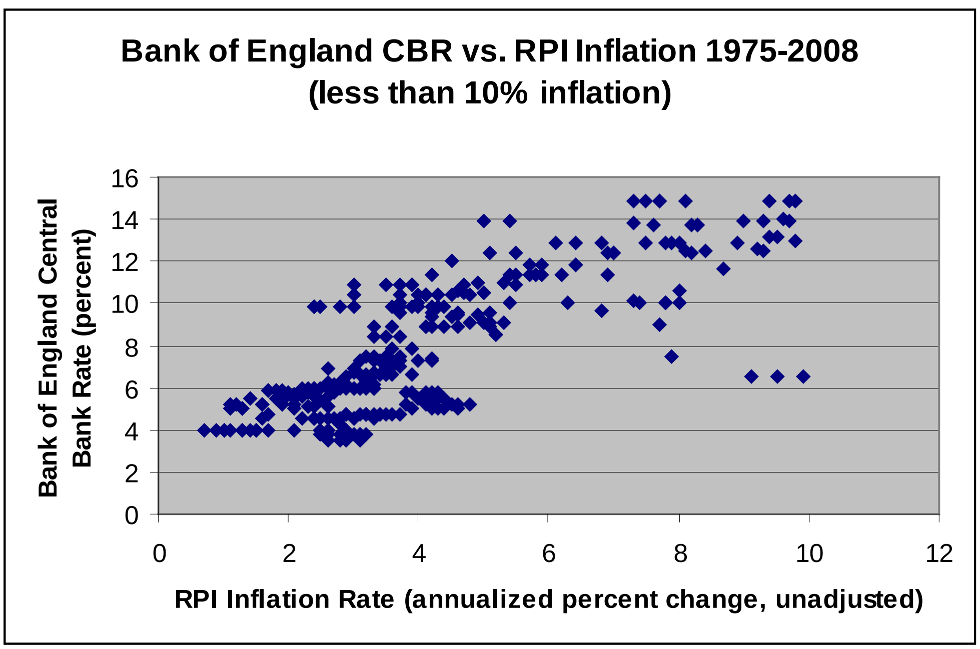
Bold numbers indicate statistically significant slope coefficients and respective confidence intervals under a hypothesis of β1=0, while italicized numbers indicate not statistically significant under this hypothesis. Underlined numbers indicate statistically significant slope coefficients and respective confidence intervals under a hypothesis of β1=1.



Again the hypothesis that the coefficient on inflation is unity fails at the 0.05 significance level and yields an estimate for the inflation coefficient even further from 1 than the U.S. estimate (0.4105017 vs. 0.8729469 for the U.S.) The regression suggests the same logarithmic bend in the data, beginning to flatten when inflation nears 10%.

Now I test the second hypothesis that the coefficient is closer to one in higher inflation environments (defined via the apparent curve as expected inflation greater than or equal to 10 percent). Below are the scatter plots for these two divisions of inflation environments. Please refer back to Table 2 for hypothesis test results.





This secondary hypothesis also fails since each period yields a slope estimate that rejects the null hypothesis of unity. Moreover, neither period yields a slope estimate that is visibly closer to unity than the other.

0.6793586	1.474288

The greater slope estimate in the low-inflation period is indicative of this logarithmic bend in the long-term British data (that is, the higher the inflation, the smaller magnitude the slope estimate will have).

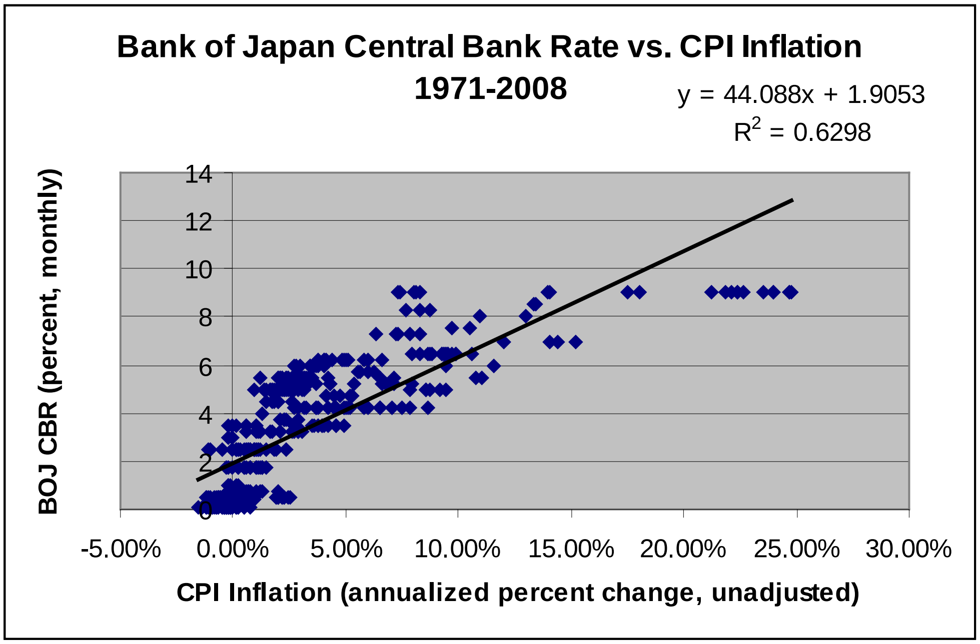
4.3 Japan:
The time period studied for Japan is January 1971 to June 2008.

Inflation Data for Japan is drawn from RateInflation.com, a historical CPI database.

Bank of Japan Discount Rates supplied by Bank of Japan online database and Economagic.com (for rates between 1995 and 2001). Note that the slope coefficients here are scaled upward by a factor of 100 in the graphs; divide by 100 to get the appropriate estimator for the slope coefficient.

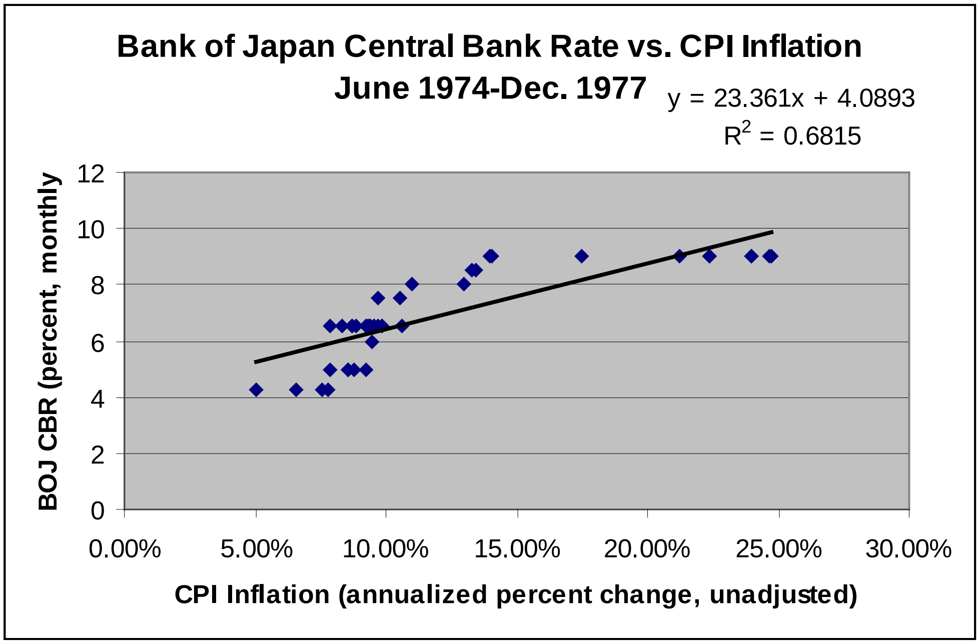
TABLE 3: JAPAN AND EU	Bank of Japan Central Bank Rate vs. CPI inflation rate January 1971-June 2008	Japan Central Bank Rate vs. CPI inflation rate June 1974-December 1977	Japan Central Bank Rate vs. CPI inflation rate January 1999-December 2007	European Union Central Bank Rate vs. HICP inflation rate January 1999-June 2008
Number of Observations	450	42	108	114
OLS Slope Coefficient Estimate	**0.4408776**	**0.236529**	*0.0793545*	**0.4700622**
OLS t-statistic	27.61	8.97	1.75	3.2
OLS p-value	0	0	0.083	0.002
OLS standard error	0.0159699	0.0263765	0.0453294	0.1471167
OLS 95% Confidence Interval	**.4094923 .4722628**	**.18322 .2898379**	*-.0105156 .1692245*	**.1785693 .7615551**
White t-statistic	18.65	9.71	1.86	5.11
White p-value	0	0	0.065	0
White standard error	0.0236371	0.0243686	0.0425653	0.0920724
White 95% Confidence Interval	**.3944242 .487331**	**.1872783 .2857797**	*-.0050354 .1637443*	**.2876326 .6524918**
R-squared	0.6298	0.6678	0.0281	0.0835

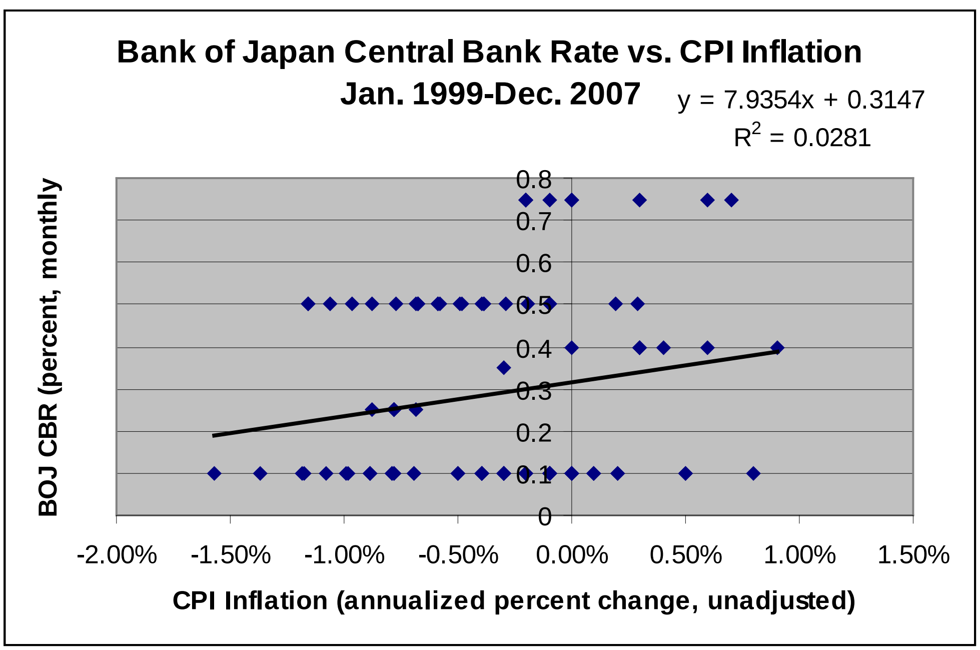
Bold numbers indicate statistically significant slope coefficients and respective confidence intervals under a hypothesis of β1=0, while italicized numbers indicate not statistically significant under this hypothesis. Underlined numbers indicate statistically significant slope coefficients and respective confidence intervals under a hypothesis of β1=1.



One again observes a slope coefficient that is statistically significantly different from 1, as well as the usual logarithmic bend that begins to flatten at about 10% inflation.

I now look at two historical periods as with the data from the United States: the June 1974-December 1977 period of very high inflation due to the global oil crisis (productivity/supply/uncertainty shock), and the "Lost Decade." Here I define this latter period as January 1999-Dec 2007, during which inflation persisted below 1%. The second hypothesis would suggest an expected-inflation coefficient very close to 1 in the former period, and an expected-inflation coefficient in the former period that is much farther away from 1 and should be close to 0. Please refer back to Table 3 for the regression test results.



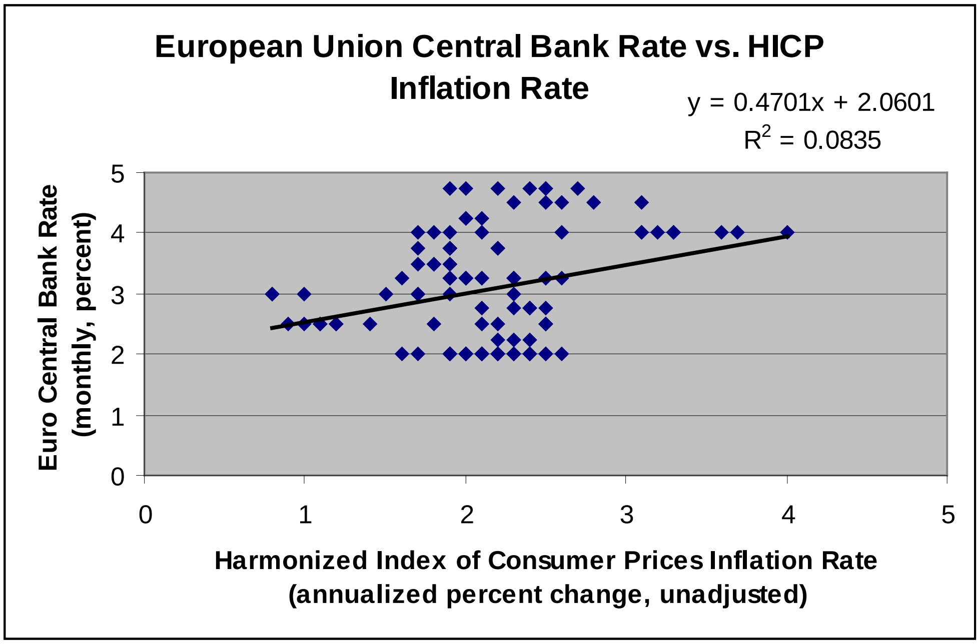


These regressions show that the hypothesis holds for the Lost Decade, a slope coefficient on inflation that is very close to 0. Surprisingly, Japan's oil crisis period also has a slope coefficient statistically significantly different from unity, but it is also rather far away from 1 and in fact quite nearly runs into the confidence interval for the Lost Decade coefficient (cf. Table 3.)

4.4 Euro Zone:
European data only cover the time period from January 1999 (when the Euro was centrally adopted) and June 2008. European Central Bank Rate data come from the Bank of Japan online database, and include the fixed and variable interest rate targets for the time periods when these targets were primarily used. HICP (Harmonized Index of Consumer Prices) Inflation data also comes from the ECB database. (Again note that there have as yet been no periods post-Euro adoption when the HICP has been 5% or greater.)

European Union Central Bank Rate vs. HICP inflation rate January 1999-June 2008
114
0.4700622
3.2
0.002
0.1471167
.1785693 .7615551
5.11
0
0.0920724
.2876326 .6524918
0.0835
Bold numbers indicate statistically significant slope coefficients and respective confidence intervals under a hypothesis of b1=0, while italicized numbers indicate not statistically significant under this hypothesis. Underlined numbers indicate statistically significant slope coefficients and

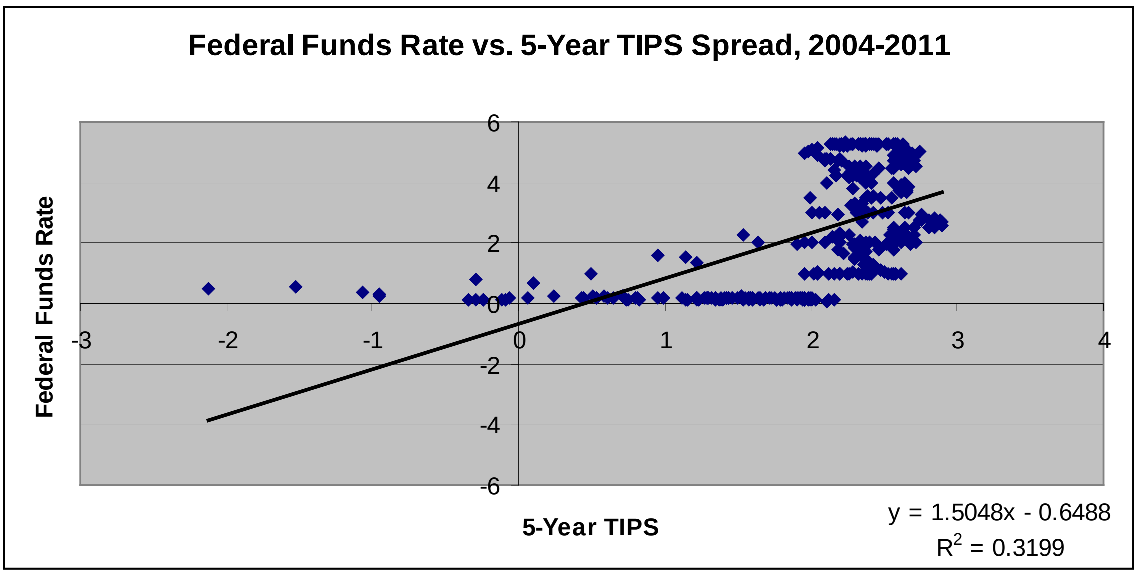
respective confidence intervals under a hypothesis of $\beta 1=1$.



This final regression indicates significantly different slope coefficients from 1, in keeping with rejecting the simple Fisher relationship; but the European data presents a particular challenge. While yielding results consistent with Britain and Japan as far as the general Fisher hypothesis is concerned over the entire history of the standardized Euro, the fact that this data only cover a decade is a bit problematic. Since the Euro Zone has not even experienced double-digit inflation, one cannot presume to empirically explain what happens in the high-inflation environment. More data are required over the coming years to gain better insight as to the European CBR and HICP correlation.

5. The Federal Funds Rate and TIPS Spread:

The TIPS Spread is the difference in return between nominal United States Treasury Bonds and the United States Treasury's Treasury Inflation-Protected Securities, that guarantee a payment in real terms. Since these were introduced in 2002, economists have used the Fisher equation to establish the TIPS Spread as a measure of investors' inflationary expectations. The time period studied here is January 2004 through February 2011, using weekly data from the Federal Reserve Board. This is a regression on the Federal Funds Rate, an overnight rate, and the TIPS Spread on 5-year Treasury Bonds. The timing mismatch is not to be overlooked, but 5 years is the shortest term possible at this time for the TIPS spread to be measured.



As we see in Table 4, the regression coefficient (1.5048), calculated both under OLS and correcting for heteroskedasticity, is statistically significant but lies well above $\beta_1 = 1$. While this is a better result relative to many coefficients not even reaching 1, there is still a large discrepancy between the real-life relationship between the FFR and the "expected inflation" given by the 5-year TIPS and the Fisher equation. Again, there is a huge timing mismatch that may account for this error in the coefficient. However, the TIPS spread will become a huge data resource in years to come for macroeconomists and financial economists in studying moderate to long-term responses by the Fed in the

United States. This is also true for Gilt bonds, which are the Bank of England counterparts to the TIPS. What would be most beneficial for economists to study the very short-term nominal rate given by the Federal Funds Rate versus short-term inflationary expecations would be a shorter-term TIPS bond that would allow for perhaps 1-month or even shorter time frames to measure the TIPS spread and perhaps capture "inflation expectations" over a very short time frame.

6. Conclusions:

The data overwhelmingly suggest some relationship (here, always positive) between the central bank's nominal interest rates and inflation, borne out by the simple hypothesis test

$H_0 : \beta_1 = 0$
$H_1 : \beta_1 \neq 0$, Yet on the whole it is clear that the simple Fisher hypothesis that states that
$\alpha = 0.05$

as inflation increases by 1 percent, the nominal interest rates (set and reflected by central banks) also rise one-for-one is rejected by the data. This rejection occurs across all the data sets from all the countries examined. Moreover, the second hypothesis that the Fisher correlation (i.e. a slope coefficient closer to 1) is more likely in higher inflation environments is also rejected. On the contrary, the inflation and interest rate data appears to have a logarithmic bend, steeper toward null inflation and flatter as inflation increases. This occur because high interest rates are politically untenable, even when hyperinflation threatens, especially if there is also high unemployment as was the case in most of the West in the 1970s. However, an inclusion of more countries that have experienced persistent high inflation (e.g. Argentina, Chile, and Italy pre-Euro) may still confirm the secondary hypothesis as central banks adjust to this persistently high inflation and adjust rates commensurately. Also, at the other end of the inflation continuum is persistently low inflation that does not appear to have any correlation with the central bank rate, as seen during Japan's Lost Decade. It is very uncommon that nominal interest rates drop below zero, so mathematically, one expects a flattening of the curve at this end, and indeed, the data reflect this. To incorporate more countries into this study and to explore further econometric methods of testing these hypotheses would strongly benefit the research. This could perhaps be accomplished using a model that regresses the changes in inflation and nominal interest rates, or one that incorporates a statistical expected inflation value as opposed to one based on rational expectations. If, however, this "Quasi-Fisher Curve" persists even in those other models and in other countries with a history of high inflation, it is worth examining what the role of central banks should be at different points on the curve. During the current so-called Great Recession, central banks took radical steps to raise money market liquidity directly, practices that would be in keeping with the steeper part of the curve near zero inflation. As this research is furthered, it is the author's intent to attempt to clarify how a central bank does and should utilize its interest-rate monetary policy tool. The TIPS Spreads and their foreign analogues as they are developed will be a valuable resource for years to come in studying Fisher Hypothesis and Fisher Equation-related anomalies and other phenomena.

WORKS CITED

Alvarez, Fernando, Robert E. Lucas, Jr., and Warren E. Weber. "Interest Rates and

Inflation." Federal Reserve Bank of Minneapolis Research Department, January 2001, http://www.jstor.org (accessed January 25, 2010).

Cochrane, John H. "Inflation Determination With Taylor Rules: A Critical Review," *University of Chicago Booth School of Business and NBER*, September 12, 2007, http://faculty.chicagobooth.edu/john.cochrane/research/Papers (accessed January 25, 2010).

Cochrane, John H. "Understanding Fiscal and Monetary Policy in 2008-2009," *University of Chicago Booth School of Business and NBER*, October 11, 2009, http://faculty.chicagobooth.edu/john.cochrane/research/Papers (accessed January 25, 2010).

Hafer, R.W. and Scott E. Hein. "Forecasting Inflation Using Interest-Rate and Time-Series Models: Some International Evidence." The Journal of Business, Vol. 63, No. 1, Part 1 (Jan., 1990), pp. 1-17, The University of Chicago Press, http://www.jstor.org/stable/2353234 (accessed January 25, 2010).

Taylor, John. "Discretion Versus Policy Rules in Practice." Carnegie-Rochester Series on Public Policy 39 (1993), http://www.jstor.org (accessed January 25, 2010).

Virén, Matti. "Inflation and Interest Rates: Some Time Series Evidence from 6 OECD Countries." empec, Vol. 12, 1987, pp.51-56, Physica-Verlag, Heidelberg. http://www.jstor.org (accessed January 25, 2010).

Regression Result Tables

TABLE 1: UNITED STATES	United States Federal Funds Rate vs. CPI inflation rate July 1954-June 2008	United States FFR vs. CPI inflation rate July 1954-December 1972	United States FFR vs. CPI inflation rate January 1973-July 1979	United States FFR vs. CPI inflation rate August 1979-August 1987	United States FFR vs. CPI inflation September 1987-April 2006

Number of Observations	651	222	79	97	224
OLS Slope Coefficient Estimate	**0.8729469**	**0.8663554**	**0.6650286**	**0.6651686**	**1.333803**
OLS t-statistic	29.87	20.11	7.3	11.48	12.86
OLS p-value	0	0	0	0	0
OLS standard error	0.0292203	0.043071	0.0910551	0.057927	0.1037231
OLS 95% Confidence Interval	**.8155691 .9303246**	**.7814709 .95124**	**.4837148 .8463425**	**.550169 .7801683**	**1.129395 1.538211**
White t-statistic	21.86	18.53	7.14	8.91	12.74
White p-value	0	0	0	0	0
White standard error	0.0399329	0.0467666	0.0931219	0.074681	0.1046818
White 95% Confidence Interval	**.7945336 .9513601**	**.7741877 .9585232**	**.4795993 .8504579**	**.516908 .8134292**	**1.127505 1.5401**
R-squared	0.579	0.6478	0.4092	0.5812	0.4269

Bold numbers indicate statistically significant slope coefficients and respective confidence intervals under a hypothesis of $\beta 1=0$, while *italicized* numbers indicate not statistically significant under this hypothesis.

TABLE 2: UNITED KINGDOM	United Kingdom Bank of England Central Bank Rate vs. RPI inflation rate January 1975-June 2008	United Kingdom CBR vs. RPI inflation rate January 1975-June 2008; RPI inflation rate greater than or equal to 10%	United Kingdom CBR vs. RPI inflation rate January 1975-June 2008; RPI inflation rate less than 10%
Number of Observations	395	same; used dummy variable to indicate high or low inflation	

OLS Slope Coefficient Estimate	**0.4105017**	**0.6793586**	**1.474288**
OLS t-statistic	16.31	44.33	38.18
OLS p-value	0	0	0
OLS standard error	0.0251654	0.0153243	0.0386113
OLS 95% Confidence Interval	**.3610261 .4599773**	**.6492308 .7094865**	**1.398378 1.550199**
White t-statistic	11.29	19.85	28.97
White p-value	0	0	0
White standard error	0.0363608	0.034217	0.0508934
White 95% Confidence Interval	**.3390156 .4819878**	**.6120874 .7466299**	**1.374231 1.574346**
R-squared	0.4037	0.8334	0.7877
Bold numbers indicate statistically significant slope coefficients and respective confidence intervals under a hypothesis of β1=0, while italicized numbers indicate not statistically significant under this hypothesis.			

TABLE 3: JAPAN AND EU	Bank of Japan Central Bank Rate vs. CPI inflation rate January 1971-June 2008	Japan Central Bank Rate vs. CPI inflation rate June 1974-December 1977	Japan Central Bank Rate vs. CPI inflation rate January 1999-December 2007	European Union Central Bank Rate vs. HICP inflation rate January 1999-June 2008
Number of Observations	450	42	108	114
OLS Slope Coefficient Estimate	**0.4408776**	**0.236529**	*0.0793545*	**0.4700622**
OLS t-statistic	27.61	8.97	1.75	3.2

OLS p-value	0	0	0.083	0.002
OLS standard error	0.0159699	0.0263765	0.0453294	0.1471167
OLS 95% Confidence Interval	**.4094923 .4722628**	**.18322 .2898379**	*-.0105156 .1692245*	**.1785693 .7615551**
White t-statistic	18.65	9.71	1.86	5.11
White p-value	0	0	0.065	0
White standard error	0.0236371	0.0243686	0.0425653	0.0920724
White 95% Confidence Interval	**.3944242 .487331**	**.1872783 .2857797**	*-.0050354 .1637443*	**.2876326 .6524918**
R-squared	0.6298	0.6678	0.0281	0.0835
Bold numbers indicate statistically significant slope coefficients and respective confidence intervals under a hypothesis of $\beta 1=0$, while italicized numbers indicate not statistically significant under this hypothesis.				

TABLE 4: FFR AND U.S. TIPS SPREADS	United States Federal Funds Rate and TIPS Spread January 2004-February 2011
Number of Observations	373
OLS Slope Coefficient Estimate	**1.504776**
OLS t-statistic	13.21
OLS p-value	0
OLS standard error	.1139051
OLS 95% Confidence Interval	**1.280796 1.728**
White t-statistic	10.66
White p-value	0
White standard error	0.1411781
White 95% Confidence Interval	**1.227167 1.782**
R-squared	0.3