Testing the Fisher Hypothesis: 
A Survey of Empirical Studies*

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1. Introduction

In its simplest form, the Fisher hypothesis postulates a one-for-one relationship between the nominal interest rate and the expected inflation rate, i.e. that the nominal interest rate increases by 1% for every 1% increase in the expected inflation rate. If the Fisher hypothesis holds true, then it has important practical implications for the monetary policy, the super-neutrality of monetary policy, the usefulness of interest rates as monetary policy targets and the predictability of inflation rates using nominal interest rates. However, as is often the case with applied economics, robust results on the empirical validity of the Fisher hypothesis are difficult to find. There is a huge volume of both empirical and theoretical work, starting with the original paper by Irving Fisher (1930), which found a one-for-one relationship between nominal interest rates and inflation rates. Attempts to replicate such results have led to a wide variety of studies using varying techniques, time periods and data from a wide range of countries 1). This paper

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1) There are few surveys on testing the Fisher hypothesis, including Cooray (2003), a brief but excellent survey.
attempts to summarize some of the results from this body of literature by focusing on empirical testing methods, which have changed over time as econometric techniques have changed and developed.

The structure of this paper is as follows. Section 2 briefly discusses the meaning and importance of the Fisher hypothesis. Sections 3 to 5 provide an overview of testing the Fisher hypothesis according to the development of techniques. Section 3 looks at the original work of Fisher (1930) and various others who attempted to extend and replicate his tests. Section 4 proceeds with the seminal work of Fama (1975), which placed the testing of the Fisher hypothesis in the context of efficient markets and rational expectations and marked a significant shift in the methodology used to test the hypothesis. Section 5 focuses on more recent attempts to test the hypothesis using modern time series techniques, in particular those associated with the development of tests for nonstationarity (unit root) and long-run relationships (cointegration). Section 6 discusses the results from a large body of work (empirical and theoretical) that found no support for the Fisher hypothesis and attempted to explain why the Fisher hypothesis was not supported. The empirical literature reviewed in Sections 2 to 6 focuses largely on studies based on US data; therefore, the final three sections of this chapter review briefly the literature from Japan (Section 7), Australia (Section 8) and other countries (Section 9). Section 10 attempts to summarize the results discussed and puts them into perspective.

2. The Meaning of the Fisher Hypothesis

The Fisher hypothesis is based on the following identity, which simply states that the nominal interest rate is the sum of the ex ante real interest rate and the expected inflation rate.
\[ R_t = E_t r_t + E_t \pi_{t+1} , \]  \hspace{1cm} (1)

where \( R_t \) is the nominal interest from \( t \) to \( (t+1) \) and \( E_t \) is the expectation operator for period \( t \); therefore, \( E_t r_t \) is the real interest rate expected to hold from period \( t \) to \( (t+1) \) and \( E_t \pi_{t+1} \) is the expected inflation rate from period \( t \) to \( (t+1) \). This identity is called the Fisher equation after Irving Fisher, who originally discussed the idea that, when the interest rate is considered, it is important to distinguish between nominal and real rates. If we then suppose that the real interest rate is constant (as determined by the rate of return on capital), equation (1) clearly demonstrates a one-for-one relationship between nominal interest rates and expected inflation rates. This concept is the Fisher hypothesis, or as it is sometimes referred to, the Fisher effect. Economists typically use the phrase ‘Fisher effect’ as shorthand for the potential effects of monetary policy on interest rates in the context of equation (1). Thus, the Fisher effect tells us that when a loose monetary policy causes an increase in the money supply, an increase in the expected inflation rate due to this increase in the money supply will lead to an increase in nominal interest rates, as suggested by the Fisher equation (1). Whilst the implications of equation (1) are that, with constant real rates of return, any increase in expected inflation will lead to a one-for-one increase in nominal interest rates, this strict interpretation is sometimes dropped when economists refer to the Fisher effect. Often, the Fisher effect is more loosely interpreted as the effect of a 1% increase in expected inflation rates on nominal interest rates that increase by \( \alpha \% \), where \( 0 < \alpha \leq 1 \).

Before moving on to review at the empirical testing of the Fisher hypothesis, it is worth briefly noting the importance of the hypothesis.

First, as suggested by the discussion above, empirical support for the Fisher hypothesis suggests the super-neutrality of money. As equation (1) suggests, the
real rate of interest equals the nominal rate minus the expected inflation rate. These move one for one; therefore, monetary policy changes to the money supply affect nominal variables but not real variables. This is the key statement for classical economics: support for the Fisher hypothesis implies the impotence of monetary policy.

The second implication is associated with the problem of the monetary policy target, i.e. whether interest rates or a monetary aggregate are more adequate as an instrument of monetary policy. The original theoretical discussion of this problem was put forward by Poole (1970) in the context of a stochastic version of the IS-LM model. Poole’s analysis clarified the choice to be made between interest rates and quantity instruments and that the incorrect choice would lead to greater output volatility. Gibson (1970b, 1970c) classified three effects of monetary policy on nominal interest rates. For example, when a loose monetary policy increases the supply of money, this increase in the money supply induces a decrease in interest rates in the short run as a result of the liquidity effect. In the controversy for the monetary policy target, economists thought that a loose monetary policy decreases interest rates. Actually, a loose monetary policy increases interest rates because of the income effect and the expected inflation effect (the Fisher effect) as inflation occurs. In particular, the Fisher effect matters greatly during a period of high inflation. A decrease in interest rates stimulates demand for investments and so on, encouraging interest rates to increase through the income effect. Moreover, an increase in expected inflation rates increases nominal interest rates more than their original level in the long run. As a result, a loose monetary policy increases, not decreases, interest rates. Consequently, the monetary authority cannot control interest rates as an intermediate target for monetary policy. During the 1970s in Japan and other OECD countries, with the above controversy, research for
monetary economics produced literature on testing the Fisher effect to assess the adequacy of interest rates as a policy target. In the 1970s, policy management has switched to making monetary aggregate more important than interest rates when inflation accelerated. Therefore, with respect to controlling monetary policy, it matters whether the Fisher effect holds or not, as do the size and adjustment rate for the Fisher effect.

Finally, an increase in money supply as a result of monetary policy does not affect real interest rates, assuming that real interest rates are determined only by the real sector. Therefore, in accordance with the Fisher hypothesis, a change in future inflation rates, i.e. a change in expected inflation rates, causes the same change in nominal interest rates. The one-for-one relationship between nominal interest rates and expected inflation rates means that we can forecast future inflation rates by observing movements in nominal interest rates because information on future inflation is fully contained in such nominal interest rate movements.

As the above suggests, the Fisher hypothesis embodies important implications for macroeconomic policy. Thus, its empirical validity or otherwise has been the subject of a large body of empirical work. The following sections provide a brief survey of some of this evidence.

3. Initial Tests of the Fisher Hypothesis

A. H. Gibson found evidence to suggest that a positive relationship exists between nominal interest rates and price levels. John M. Keynes named the relationship the Gibson Paradox. He referred to the finding as a paradox because there should be a negative relationship between nominal interest rates and price levels from the perspective of the theory at the time. According to Knut Wicksell, 4)

3) On the Gibson Paradox, J.M. Keynes referred to Gibson’s series of articles in Banker’s Magazine, in particular January 1923 and November 1926. See Keynes (1930, pp. 177-186).
4) See Wicksell (1965).
to attain the equilibrium that equates investment with saving in the real sector, the ex ante interest rate is called the natural interest rate and is considered stable over time. However, the actual rate, i.e. the market interest rate, tends to fluctuate in the short run. If the market interest rate rises and becomes higher (lower) than the natural rate, savings exceed (lag) investments. This leads to the development of a deflationary (inflationary) gap and price levels fall (rise). Therefore, ‘Classical Theory’ suggests a negative relationship between nominal interest rates and price levels.

Fisher (1930, Ch. 19, pp. 399-451) explained the Gibson Paradox by noting the distinction between real interest rates and nominal interest rates; at equilibrium, the nominal interest rate is the sum of the returns on real assets (the equilibrium real interest rate) and the expected inflation rate. When the purchasing power of money is stable, the real and nominal interest rates are constant. However, the value of money changes over time. If fluctuations in the value of money are perfectly foreseen and the purchasing power of money decreases by 1%, then nominal interest rates become 1% higher than real interest rates. Therefore, the inverse one-for-one relationship between the change in the purchasing power of money and that of the nominal interest rate is clear and implies a positive one-for-one relationship between nominal interest rates and inflation rates, since an increase in inflation implies a decline in the value of money. However, in practice, it is frequently the case that changes in the value of money are not perfectly foreseen and agents make forecasts of expected changes. Expected inflation rates forecast a change in the purchasing power of money, and Fisher argued that expected inflation rates could be deduced from a distributed lag of prior inflation rates. This suggests that a positive relationship exists between nominal interest rates and price levels that are explained by the accumulation of lags in prior inflation rates.

This idea formed the basis of the initial empirical work that was carried out by...
Fisher, who estimated the correlation coefficient between the return on the long-term bond and the expected inflation rate (proxied using a linear distributed lag of actual inflation). His initial results showed that:

- Using quarterly US data for the period 1890-1927, the maximum correlation coefficient was 0.857 and used a lag length on inflation rates for the past 20 years.
- Using quarterly UK data for the period 1898-1924, the maximum correlation coefficient was 0.98, with a lag length of 28 years.

Therefore, the Gibson Paradox, which is the positive relationship between long-term bond returns and price levels, is interpreted as a response of the long-term bond return to expected inflation rates. However, Fisher’s results suggested that actual inflation rates affect expected inflation rates for a surprisingly long time, with lags of 20 to 30 years, thus leading to the highest positive correlations in the data.

In summarizing his ideas in the final part of chapter 19 of Fisher’s (1930), The Relation of Interest on Money and Price, he indicated that there is a remarkably high correlation between inflation rates and interest rates. However, he also indicated that changes in interest rates lag inflation rates for a long time and sometime for a surprisingly long time. He concluded that interest rates change according to changes in the real sector when the purchasing power of money is stable. On the other hand, interest rates change according to a change in the purchasing power of money when the purchasing power of money is unstable. It is perhaps worth quoting some of his comments from the summary of chapter 19:

“We have found evidence general and specific, from correlating P’ 5) with both bond yields

5) Note that P’ means the inflation rate.
and short term interest rates, that price changes do, generally and perceptibly, affect the interest rate in the direction indicated by a priori theory. But since forethought is imperfect, the effects are smaller than the theory requires and lag behind price movements, in some periods, very greatly. When the effects of price changes upon interest rate are distributed over several years, we have found remarkably high coefficients of correlation, thus indicating that interest rates follow price changes closely in degree, though rather distantly in time.

The final result, partly due to foresight and partly to the lack of it, is that price changes do after several years and with the intermediation of change in profits and business activity affect interest very profoundly. In fact, while the main object of this book is to show how the rate of interest would behave if the purchasing power of money were stable, there have never been any long period of time during which this condition has been even approximately fulfilled. When it is not fulfilled, the money rate of interest, and still more the real rate of interest, is more affected by the instability of money than by those more fundamental and more normal causes connected with income impatience, and opportunity, to which this book is chiefly devoted.' (Fisher, 1930, p. 451, Chapter 19, Section 13 Summary)

Thus, Fisher (1930) found surprisingly long distributed lags in estimating expected inflation rates. Although he argued that the cause of the longer lags was potentially the result of the incompleteness of both expectations and the adjustment in the determination of expected inflation rates, the lag length of the expected inflation rate in the empirical work was seen as troublesome and difficult to justify in reality. Fisher (1930) did not test the size of the Fisher effect, but simply estimated the correlation coefficient between nominal interest rates and expected inflation rates and postulated that a 1% increase in expected inflation rates leads to a 1% increase in nominal interest rates.

Since the 1970s, when the major economies of the world started to experience both higher and more volatile inflation rates, the literature on testing the Fisher
effect focused on two key issues: the length of the lag and the size of the Fisher effect. To confirm the results of Fisher (1930), papers such as Meiselman (1963), Sargent (1969), Gibson (1970a), Yohe and Karnosky (1969) and Lahiri (1976) forecasted expected inflation rates using a range of distributed lag models, tested the Fisher hypothesis and estimated the size of the Fisher effect using the following basic model structure.

\[
\begin{align*}
R_t &= E_t r_t + E_t \pi_{t+1} \\
R_t &= \alpha + \beta E_t \pi_{t+1} + \epsilon
\end{align*}
\]

Equation (2) simply recalls the original Fisher equation as denoted in Section 2. Assuming that the ex ante real interest rate is a constant \( \alpha \), the Fisher hypothesis is that \( \beta = 1 \) can be tested using equation (3).

\[
E_t \pi_{t+1} = \sum_i w_i \pi_{t-i}
\]

Expected inflation is estimated using the distributed lag model in (4). Putting the estimated value of expected inflation rate from the regression model (4) into the second term on the right-hand side of (3) can test whether the hypothesis that \( \beta = 1 \) in (3) is supported or not. Most literature substitute equation (4) in equation (3) and estimate model (5) to test whether the sum of the values of the coefficients in the distributed lags is equal to or less than one. Note that the test using model (5) could not identify the difference between the hypothesis \( \beta = 1 \) and the size of the effect of the expected inflation rate from the distributed lag model. Basically, we should test the Fisher hypothesis using model (3) with the expected inflation rate derived from (4). However, we also summarize the testing in the literature based on model (5).

We first review some of the results in the context of the required length of the distributed lags. Meiselman (1963), Sargent (1969) and Gibson (1970a), who employed
several distributed lags, i.e. Koyck, geometric decreasing and unconditional distributed lags respectively, found that by using data before World War II the estimated length of distributed lag models was enough to support Fisher (1930).

Meiselman (1963), using annual US data on returns on corporate bonds and WPI for the period 1873-1960, applied the adaptive expectations and found a mean lag of 13 years, which supported the long lag length although the size of the Fisher effect was very small before World War II. Sargent (1969), using annual US data for the period 1902-1940, determined the effect on nominal interest rates of surprisingly long distributed lags for price change variables, even while taking into account the other monetary and real variables. Gibson (1970a) used annual short- and long-term interest rate data for the period 1869-1963 and quarterly data for the period 1948-1963 and found the long-run effect of the expected inflation rate on nominal interest rates, although the size of the effect is less than one.

In another aspect of the literature, Yohe and Karnosky (1969), Feldstein and Eckstein (1970), Carr and Smith (1972) and Lahiri (1976) showed that the length of the lag required to capture the formation of the expected inflation rate was shortened in the 1960s. Using monthly data from the US for the period 1952-1969, Yohe and Karnosky (1969) analysed the relationship between nominal interest rates and inflation. The yield on 3A corporate bonds was used as long-term rates, the four to six month CP (Commercial Paper) rate was used as a short-term rate and the inflation rate was measured using the CPI. Yohe and Karnosky (1969) conducted regression analyses, in which the regressand was the nominal interest rate and the distributed lags of prior inflation rates were regressors. Almon distributed lag models 6) were adopted and three types of lag lengths, 24, 36 and 48 months, were used to estimate the regression models. The results are summarized by

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6) The Almon distributed lag model is one of the distributed lag models and assumes that the shape of the distribution is polynomial, meaning that we can flexibly determine the shape.
two points. First, the maximum of the determination coefficients was 0.771, using short-term interest rates in the case of the three-year lag length and 0.549, using the long-term interest rates in the case of the four-year lag length. The determination coefficients were rather large, although not as large as in the case of Fisher (1930). Second, the duration of the effect of expected inflation on the nominal interest rate is within two years and the latest period has the maximum effect. Therefore, Yohe and Karnosky (1969) showed that the distribution lags were not as long as Fisher (1930) insisted. This tendency appeared in Feldstein and Eckstein (1970) and Carr and Smith (1972), which employed the Almon distributed lag model. Polynomial distributed lag models are considered to have shorter lags than monotonic decreasing distributed lags. Moreover, Lahiri (1976) found that the some formations expect the inflation to adjust much faster.

The reduction in the lag length of the distributed lags model depends not only on the type of the model but also on the period during which the study was undertaken. Dividing the sample periods between the 1950s and the 1960s, Yohe and Karnosky (1969) and Gibson (1972) found that the adjustment rate accelerated and the lag length shortened in the 1960s compared with the 1950s. Gibson (1972) indicated that the expected inflation rate obtained from the Livingstone survey data, which contain forecasts of future inflation rates for six or 12 month in the future and could explain most of the variation in actual inflation during the 1960s. This suggests that the adjustment rate of the expected inflation effect on nominal interest rates accelerated in the 1960s more than in the 1950s. Feldstein and Eckstein (1970) and Carr and Smith (1972) conducted the analyses using data mainly from the 1960s. It is believed that the adjustment rate of the effects of expected inflation on the nominal interest rate accelerated. The reason might be because agents needed to incorporate inflation expectations into the determination of nominal variables more rapidly to insulate themselves from losses, considering
that inflation was insistent in the 1960s.

When researchers turned to analyse the size or magnitude of the Fisher effect, they found evidence that it became larger in the 1960s than in the 1950s at the same time that the lag length shortened. Thus far, the studies used the expected inflation rate formulated by distributed lag models. However, we have a problem in selecting distributed lag models because of the arbitrariness in selecting the shape and lag length of such models. We need directly observed data, i.e. survey data to make us escape from fear to determine whether we have a wrong price formation. Although the frequency of such data is limited, the Livingstone survey data 7) is available in the US since 1946. Using survey data, we can examine, without doubting whether the price formation is correct, the magnitude of the Fisher effect. We briefly summarize the literature using the survey data, i.e. Gibson (1972), Pyle (1972), Cargill (1976), Lahiri (1976) and Cargill and Meyer (1980).

Gibson (1972) used the Livingstone survey data as expected inflation rate instead of the distributed lag model. Using US data between 1952 and 1970 and dividing the entire period into two periods, i.e. the 1950s and 1960s, Gibson (1972) found that the estimated coefficient of the expected inflation rate in the 1950s was less than 0.5, while that estimated coefficient during the 1960s was nearly one. Yohe and Karnosky (1969) indicated the same results. Using the Livingstone Survey data, Cargill (1976) also tested the Fisher effect by dividing the sample period into two periods, i.e. the 1950s and 1960s. He found that most of the results of the estimation coefficients for the expected inflation rate were not significant in the 1950s, while the coefficients were almost significant and their size was supported to be one in the 1960s. Therefore, the faster the inflation rate grew in the 1960s,

7) The Livingstone Survey is produced by Joseph Livingstone, who was a nationally syndicated financial columnist. It has surveyed twice a year since 1946 from a group of business, government, labor and academic economists on their expectations of future values of macroeconomic variables including the consumer price index. See Gibson (1972).
the larger the effect on nominal interest rates. However, Cargill and Meyer (1980) examined the Fisher effect, dividing the period into three subperiods, i.e. 1954-59, 1960-69 and 1970-75. As a result, the relationship between the nominal interest rate and inflation is fairly unstable, which is inconsistent with the other two studies.

Although they did not divide the sample period, Pyle (1972) and Lahiri (1976) examined the Fisher effect using the Livingstone survey data. Pyle (1972), using US data for 1954-1969, obtained the results that the coefficient was nearly 1.0 when using 12-month forward data, while the result using six-month forward data was less than one. For the 1952-1970 samples, Lahiri (1976) incorporated the Livingstone survey data into four expectation formations and found that the size of the effect was 0.7-0.9. The coefficient increased because both studies contained data from the entire 1960s.

As described above, the length of the distributed lags was shorten in the 1960s and the result was accepted by researchers. Moreover, the magnitude of the Fisher effect grew. However, this magnitude had been by and large less than one since Yohe and Karnosky (1969). Therefore, it is conceivable that the Fisher hypothesis is not fully supported in empirical studies.

Since the seminal work of Fisher (1930), a large volume of literature has been devoted to empirical work to test the Fisher effect. Research following Fisher had two questions related to the results in Fisher (1930), i.e. far longer length of distributed lags and the one-for-one relationship between the nominal interest rate and inflation. Up to today, whilst the adjustment rate of the effect of the expected inflation rate on nominal interest rates was very slow when inflation was stable before the 1950s, it accelerated in the 1960s. Moreover, Fisher (1930) believed in the one-for-one relationship. However, many studies following Fisher found that the size of the Fisher effect was less than one, although it grew in the 1960s. We
will follow the literature using new approaches from here on.

4. The Influence of Fama (1975) on Tests of the Fisher Hypothesis

A major change in the way in which applied studies approached the testing of the Fisher hypothesis occurred with the publication of Fama’s seminal paper in 1975. Since Fisher (1930), regression models used to test the Fisher hypothesis assumed that current nominal interest rates could be explained by the expected inflation rate, which was estimated by some form of distributed lag model of past inflation rates. Therefore, the implicit assumption was that causality flowed from the inflation rate to nominal interest rates and that expectations were formed adaptively, i.e. that agents were backward looking when forming expectations.

Fama (1975) assumed that the market was forward looking and could correctly forecast future inflation as a stochastic expected value. If the short-term financial market is an ‘efficient market’, in the sense that it uses all available information in the determination of the equilibrium short-term nominal interest rate, the current nominal interest rate contains all of the information contained in the lags of the actual inflation rate, making distributed lag models redundant. In this model, current interest rates should therefore be good predictors of future inflation rates and the causation runs from nominal interest rate to inflation rate. Fama (1975) therefore incorporates two assumptions in the testing framework: that the market is efficient (see Fama (1970)) and that agents are rational (see Muth (1960)).

Fama (1975) estimated regression models in the form of equation (6), in which the regressand is the one-period-ahead inflation rate and the regressor is the current nominal interest rate.

$$\pi_{t+1} = \alpha + \beta R_t + u_t,$$

where $\pi$ is the inflation rate, $R$ the nominal interest rate, $\alpha$ is a constant term and equal to the minus real interest rate and $u_t$ is the error term. Whether or not
the market is efficient can be examined 1) by testing the hypothesis that $\beta = 1$, which derives the constancy of the ex ante real interest rate and 2) by testing the hypothesis that there is no serial correlation in the error term, which is interpretable as reflecting market efficiency. When these hypotheses hold, the Fisher hypothesis is completely supported and the nominal interest rate contains complete information about past inflation under rational expectations and the constant ex ante real interest rate.

Using monthly US data between 1953 and 1971, with the reciprocal of the rate of one-period changes in CPI as the change in purchasing power of money and using one- to six-month Treasury Bills as the nominal interest rate, Fama’s (1975) results suggested that the hypothesis that the coefficient of the nominal interest rate is one could not be rejected. He calculated the autocorrelations of inflation rates and real interest rates from one to twelve months and found a high autocorrelation of inflation rates, showing that past inflation rates have information on expected inflation rates. Moreover, he found no autocorrelation of real interest rates, indicating that real interest rates are constant. Fama (1975) also estimated the regression model in (6) augmented with the addition of a one-period lag of the inflation rate as a regressor and found that the coefficient of the one-period lag inflation rate was not significant. Fama (1975) argued that the current nominal interest rate contains all of the information to predict one-period-ahead inflation. Overall, Fama (1975) interpreted the results as supporting the notion that the market was efficient, with the short-term interest rate fully incorporating all past information on inflation, and that real rates were constant.

Fama’s (1975) overwhelming empirical result induced a series of comments in the *American Economic Review* in 1977, i.e. the comments by Carlson (1977), Joines (1977) and Nelson and Schwert (1977) and the reply by Fama (1977). Essentially, these papers attempted to find flaws in Fama’s analysis, usually by including other
variables to test whether they had significant predictive power for inflation, thus
invalidating the idea that the current short-term interest rate fully incorporated all
information on past inflation.

For example, Joines (1977) added the Wholesale Price Index and Hess and
Bricksler (1975) and Nelson and Schwert (1977) added the forecasting value of
inflation into Fama’s regression model. The coefficients of these variables turned
out to be significant. Carlson (1977) questioned Fama’s (1975) result that all
information in future expected inflation rate falls within the nominal interest rate
given that his finding of the addition of a variable measuring business cycle factors
into the Fama’s model is significant. Moreover, Carlson (1977) found that the real
interest rate is not constant using results based on his analysis of the Livingstone
survey data on the expected inflation rate.

On the other hand, significant research (e.g. Shiller, Campbell, Schoenholtz and
Weiss (1982), Campbell and Shiller (1987) and so on) focused on the information in the
term structure of interest rates whether or not the relationship between interest
rates for different maturities can predict the future movement of the short-term
interest rate. Combining this idea with Fama’s (1975) approach, Mishkin (1990a)
proposed a method to examine the predictability of the term structure of nominal
interest rates on the future inflation rate. Mishkin (1990a) examined whether the
term structure of interest rates can predict the inflation rate and estimated the
relationship between the term structure of interest rates and the inflation spread
in the following model:

\[ \pi_t^m - \pi_t^n = \alpha + \beta [R_t^m - R_t^n] + e_t, \quad (7) \]

where \( R_t^m \) is the nominal interest rate of the \( m \) period matured, \( R_t^n \) is that of the
\( n \) period matured; therefore \([R_t^m - R_t^n]\) is the nominal interest spread matured
between the \( m \) period and the \( n \) period and \([\pi_t^m - \pi_t^n]\) is the inflation spread
according to the nominal interest spread.
If $\beta = 1$ in equation (7), the nominal interest rate spread can completely forecast the inflation spread in the sense that the change in the nominal interest rate between different maturities, i.e. the term structure of nominal interest rates, is fully reflected in the change in inflation at different periods; therefore, the complete Fisher hypothesis holds. If $0 < \beta < 1$, the nominal interest spread partly forecasts the Fisher effect and the nominal interest spread contains the future inflation rate. Equation (7) means the difference of the two equations in (6) with respect to different maturities. Accordingly, the complete Fisher hypothesis is supported if coefficient $\beta$ in equation (7) is one. On the other hand, if $\beta$ is less than one and greater than zero, the Fisher effect is partly considered to be found.

Mishkin (1990a) examined equation (7) for short-term TB rates in the US and found that the coefficients of the nominal interest rates spreads were $0 < \beta < 1$, concluding that the nominal interest rates have the ability to predict future inflation. Mishkin (1990b) also examined equation (7) for the longer terms in the US, between one and five years. As a result, Mishkin (1990b) found that the nominal interest rates spreads for longer terms contained information on future inflation rates. Moreover, Jorion and Mishkin (1991) analysed data in the UK, West Germany and Switzerland for the nominal interest rate maturing in one to five years. The coefficients of the nominal interest rate spread were $0 < \beta < 1$, indicating that the nominal interest spread partly contained information on future inflation rates. Moreover, the longer the maturity, the more information on inflation was contained.

Fama (1975) indicated the overwhelming result that the full Fisher effect was supported by data in the US on one- to twelve-month TB rates and the CPI for 1953-1971, i.e. that nominal interest rates contain all information for one-period-ahead inflation rate. Since Fama (1975), many studies have been conducted as described above and studies examined the constancy of real interest rates, such
Moreover, a series of Mishkin’s studies were conducted to examine whether the
term structure of nominal interest rates contain information on future inflation. In
general, the results in this section also indicate that the size of the coefficient $\beta$ in
both (6) and (7) is $0 < \beta < 1$, indicating that the partial Fisher effect is obtained.

5. The Use of Modern Time Series Techniques to test the Fisher Hypothesis

The next key development in testing the Fisher hypothesis was the utilization
of the framework of modern time series analysis, most particularly the unit root/
cointegration framework. The finding that most macroeconomic time series are
nonstationary I(1) processes and the development of techniques to deal with
the issues that arise from this have had implications for all applied work using
time series data. The literature on unit root and cointegration is very large and
the intent is not to survey this here. Equally, the literature on testing the Fisher
hypothesis using some variant of the techniques proposed in this literature is also
large and once again a full survey is not intended here. Rather, this section aims
to simply outline the nature of the tests used, the variants and problems that have
arisen and to summarize briefly the results for the US, with Sections 7 and 8 doing
the same for Japan and Australia.

The Fisher hypothesis, as has been made clear, implies a one-for-one relationship
between the nominal interest rate and the inflation rate. In the context of recent
time series literature, this suggests that the applied researcher should first carry
out unit root tests on the nominal interest rate and the inflation rate. If the two
series are (as might be expected) nonstationary I(1) processes, then cointegration
tests are implemented. If the cointegrating vector is $(1, -1)$ (evidence of cointegration
between the two series), then it is regarded that the one-for-one relationship between
the nominal interest rate and inflation rate, i.e. the Fisher hypothesis, is supported.
On the other hand, literature exists that simply tests the stationarity of the real interest rate, arguing that support of the Fisher hypothesis is found in the case in which the real interest rate is stationary.

Table 1 below provides a perspective on a selection of studies between 1988 and 2008 that used some form of ‘modern’ time series approach to test the Fisher hypothesis. As noted above, there are now a large number of variants of the basic unit root and cointegration tests and the footnotes to the table provide a brief key to the various methods used in these papers.

Table 1 reveals a wide range of results, with some authors finding evidence in favour of the Fisher hypothesis and others failing to do so. Two general points can be made about the papers reported in Table 1.

First, most studies using Johansen’s (1988) approach to test the relation between the two variables support the Fisher hypothesis more than using Engle and Granger’s (1987) approach. Some others approaches also tend to support the Fisher hypothesis, for example, Lee, Clark and Ahn (1998), who applied methods suggested by Ahn and Reinsel (1998), and Westerlund (2008), who applied the panel cointegration test to 20 OECD countries.

Second, all of the three studies, Lanne (2001), Mehra (1998) and Mishkin (1992), divided their sample at the start of financial deregulation in 1979 and found that the Fisher hypothesis holds true before, but not after, 1979. Referring to the existing literature\(^8\), Mishkin indicated evidence of a lack of support for the Fisher hypothesis in the pre-World War II data and the period after October 1979 until 1982, although the Fisher hypothesis is widely supported for the period between 1951 and 1979. Mishkin (1992) observed that there are unit root in both

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\(^8\) Mishkin (1992) referred, for example, to Fama (1975), Mishkin (1981, 1988) and Fama and Gibbons (1982) as supporting evidence for the Fisher effect after the Fed-Treasury Accord in 1951 until the monetary regime shift in October 1979 and referred, for example, to Barsky (1987) and Huzinga and Mishkin (1986) as no supportive evidence existed before World War II and between 1979 and 1982.
Table 1  The Literature on Testing the Fisher Hypothesis Using Time Series Analyses without Consideration of Structural Break in the United States

<table>
<thead>
<tr>
<th>Literature</th>
<th>Period</th>
<th>Frequency</th>
<th>Approach</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atkins and Serletis (2003)*</td>
<td>1880-1985</td>
<td>Annual</td>
<td>ARDL Bounds Test</td>
<td>FH: Not Supported</td>
</tr>
<tr>
<td>Choudhry (1996)</td>
<td>1879-1913</td>
<td>Annual</td>
<td>COINT(JOH)</td>
<td>FH: Supported</td>
</tr>
<tr>
<td>Crowder and Wohar (1999)</td>
<td>1950-1995</td>
<td>Annual</td>
<td>COINT(Several)</td>
<td>FH: Supported</td>
</tr>
<tr>
<td>MacDonald and Murphy (1989)*</td>
<td>1955-1986</td>
<td>Quarterly</td>
<td>COINT(EG)</td>
<td>FH: Not Supported, except Fixed Exchange Rate System</td>
</tr>
<tr>
<td>Rapach and Weber (2004)*</td>
<td>1957-2000</td>
<td>Monthly</td>
<td>UNIT, COINT(Several)</td>
<td>π <del>I(0), R</del> I(1), FH:Not Supported</td>
</tr>
</tbody>
</table>
Testing the Fisher Hypothesis: A Survey of Empirical Studies  

Mitsuhiko Satake

He also observed a cointegrating relationship between them, making it clear that there is a Fisher effect in the long run in these periods and not in other periods. Therefore, Mishkin (1992) argued that the Fisher effect occurred only when a stochastic trend in both the nominal interest rate and the inflation rate was present. As Mishkin (1992) indicated, nominal interest rates and inflation rates have had a common trend since World War II and until 1979. Therefore, it could be credible that the cointegration relationship between such variables can be found and they have a common trend. Mishkin’s findings were echoed by a number of other papers that found evidence of support for the Fisher hypothesis over certain spans of data but not others. Some papers, such as Bonham (1991), attempted to relate these sorts of findings to factors influencing the economy and to determine whether the nature of the exchange rate affected the results of the Fisher equation by dividing the sample into periods of fixed and floating exchange rate regimes in the US. As a result,

<table>
<thead>
<tr>
<th>Reference</th>
<th>Period</th>
<th>Frequency</th>
<th>Method</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yuhn (1996)*</td>
<td>1979-1993</td>
<td>Quarterly</td>
<td>COINT (JOH)</td>
<td>FH: Supported in the long run</td>
</tr>
</tbody>
</table>

(Notes)

a Literature attached * tests in multiple countries including the US. The result is shown in the US only.
b UNIT is Unit Root Test, COINT is Cointegration test, EG is Engle and Granger Test, JOH is Johansen test, ECM is Error Correction Model. MS model means Markov Switching Model. ARDL Bound Test is Autoregressive Distributed Lag Bound test, that does not require the standard univariate time series of the data. The ARFIMA model is Autoregressive Fractional Moving Average model. CES is Cavanagh, Elliot and Stock’s (1995) method, which has the advantage to be asymptotically valid whether the variable is I(1) or I(0), or near unit root based on ECM.
c R is nominal interest rate, r is real interest and π is inflation rate. FH is the Fisher Hypothesis, which is a one-for-one long-run relationship between R and π. FE is the Fisher effect, whose size is classified into full, partial and non. ‘full’ means the support for the Fisher hypothesis.

there is evidence supporting the Fisher effect in consideration of ex ante real interest rates regardless of sample periods.

The results in Table 1 suggest the potential for structural breaks and changes to impact the results of the Fisher hypothesis tests. The finding that structural breaks can impact the results of unit root and cointegration tests is now well known. The results in Table 1 are limited to papers that tested the Fisher hypothesis using time series analysis without consideration for structural breaks in the US.

Clearly, Fisher hypothesis tests should consider the possibility of structural breaks in the series and the relationship between nominal interest rates and inflation. Table 2 provides a selection of papers that have re-tested the Fisher hypothesis, allowing for breaks.

We can classify the literature into the following three groups with respect to the different techniques used:

* unit root and cointegration tests that have been modified to allow for the consideration of structural breaks;
* threshold models such as the Threshold Autoregressive (TAR) models and Smooth Transition Autoregressive (STAR) models; and
* Markov Switching (MS) models.

First, the Fisher hypothesis test was conducted mainly using the unit root test for the real interest rate, with consideration for structural breaks. The stationarity of the real interest rate with break shifts is found in the US by Bai and Perron (2003), Caporale and Grier (2000), Lai (2004) and Million (2003), supporting the Fisher hypothesis. While Rapach and Wohar (2005) found the stationarity of real interest rates with structural breaks in 13 OECD countries, they also found that breaks in the inflation rate negatively corresponded to those in the real interest rate, indicating less support for the Fisher hypothesis. The study by Klug and
Nadav (1999) is the only one to reject the Fisher hypothesis and they applied Mishkin’s (1990) formula in constructing the structural break. Silvapulle and Hewarathna (2002) applied Gregory and Hansen’s (1996) cointegration test, with one structural break in the nominal interest rate and inflation rate in Australia and found cointegration supportive of the Fisher effect. Atkins and Chan (2004) and Malliaropulos (2000) found a trend-stationarity in the nominal interest rate and inflation rate with a break shift in the US. They applied the VAR approach to the detrended data and found evidence supportive of the Fisher effect. As a result of the unit root and cointegration tests with break shifts, we find that every study except for Klug and Nadav (1999), whose formulation is different from others, supported the Fisher hypothesis when considering structural breaks, while Atkins and Chan (2004) only obtained a partial Fisher effect.

Second, Bajo-Rubio, Díaz-Roldán and Esteve (2005), Lanne (2006), Maki (2005) and Million (2004) all use nonlinear threshold models mainly applied to cointegration tests, which used threshold models to examine the residuals derived from cointegrating regression. All of these studies found supportive evidence for the Fisher hypothesis, except that Bajo-Rubio, Diaz-Roldan and Esteve (2005) found the partial Fisher effect. Another approach using nonlinear models was conducted by Choi (2002) and Christopoulos and León-Ledesma (2007). They constructed nonlinear models to take two regimes into account and found evidence supportive of the Fisher hypothesis. The literature using nonlinear models indicated strong evidence that supports the Fisher hypothesis by allowing for the existence of nonlinearities in the Fisher relation.

Finally, the Markov switching model, another approach to considering multiple regimes instead of threshold models, was adopted by Evans and Lewis (1995) and Garcia and Perron (1996). Evans and Lewis (1995) applied the Markov switching model to obtain the expected inflation rate to test the relationship between nominal
### Table 2  The Literature on Testing the Fisher Hypothesis Using Time Series Analyses Allowing for Structural Breaks

<table>
<thead>
<tr>
<th>Literature</th>
<th>Countries</th>
<th>Periods</th>
<th>Frequency</th>
<th>Approacha</th>
<th>Resultsb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Million (2004)</td>
<td>US</td>
<td>1951-1999</td>
<td>Monthly</td>
<td>Coint(GH), apply STAR Model to Residual as r</td>
<td>r: I(0) with SB, FH: Supported</td>
</tr>
<tr>
<td>Rapach and Wohar (2005)</td>
<td>OECD 13 Countries</td>
<td>1960-1998</td>
<td>Quarterly</td>
<td>UNIT (BP)</td>
<td>r: I(0) with SB, π :I(0)with SB in accodance with r, FH: Not Supported</td>
</tr>
</tbody>
</table>

(Notes)

a SB is structural break. UNIT is unit root test including Bai and Perron (1998) (BP), Vogelsang and Perron (1998)(VP) and Barnejee, Lamsdane and Stock (1992)(BLS). COINT is cointegration test. GH is Garegory and Hansen (1996) cointegration test. MS model is Markov Switching model. TAR and STAR models means Threshold Autoregressive and Smooting Trasition Autoregressive models. IRF is Impulse Response Function. VECM is Vector Erroe Correction Model. ARDL Bound test is the same as Table 1.
b R is nominal interest rate, r is real interest and π is infaltion rate. FE is the Fisher effect, FH is the Fisher hypothesis, and SB is structural break. IFH is the Inverted Fisher Hypothesis.
interest rates and inflation rates. Garcia and Perron (1996) applied the Markov switching model directly to ex post real interest rates. Both of the two studies supported the Fisher hypothesis.

Mishkin (1992) indicates that the Fisher effect appears only when both the nominal interest rate and the inflation rate have stochastic trends. Therefore, many studies that have applied linear models to the analysis, do not support the Fisher hypothesis in long-term samples. However, once the nonlinear models, that considers multiple regimes and the unit root test and cointegration tests with the consideration of the structural breaks, applies, i.e. once breaks are allowed for in the test procedure, the literature gets more supportive for the Fisher hypothesis.

6. Explanations for Non-Support of the Fisher Hypothesis

Before reviewing the empirical literature on the Fisher hypothesis in Japan, Australia and other countries, it is worth briefly considering the impact on the literature of the large number of studies that found no support for the Fisher hypothesis. Justifications for the empirical failure of the Fisher hypothesis generally fall into three categories:

• the inverted Fisher hypothesis.
• asset effects (the Mundell–Tobin effect).
• tax effects (the Darby–Feldstein effect).

Carmichael and Stebbing (1983) turned the Fisher hypothesis on its head by arguing that the nominal interest rate is constant and that the real interest rate responds inversely one-for-one to the inflation rate. This hypothesis became known in the literature as, for obvious reasons, ‘the inverted Fisher hypothesis’. According to Carmichael and Stebbing (1983), people hold money because it has implicit returns like liquidity, although the nominal interest rate on money is
zero. The implicit return is almost constant and equal to the nominal return on financial assets when there is high substitutability between monetary assets and money. Therefore, the real interest rate inversely responds one-for-one to the inflation rate. Carmichael and Stebbing (1983) found initial support for an inverted Fisher effect with their results that showed a negative one-for-one relationship between the real interest rate and the inflation rate using data from 1953–1978 in the US and from 1965-1981 in Australia. Barth and Bradley (1988) re-examined the inverted Fisher hypothesis, extending the period used by Carmichael and Stebbing (1983). They found that the inverted Fisher hypothesis was not supported and that the value of the coefficient used to test the hypothesis decreased to much less than one in the sample from 1953 to 1984. In interpreting their results, they argued that a structural break in the Fisher relationship occurred after 1979. After the 1990s, the inverted Fisher hypothesis was tested by Inder and Silvapulle (1993) in Australia and Choudhry (1997) in Belgium, France and Germany. They found that the inverted Fisher hypothesis was rejected. However, Choi (2002) found that the inverted Fisher hypothesis was supported when inflation is low and stable and that the Fisher hypothesis was supported when inflation persists, using the threshold autoregressive model (TAR model) with two regimes. Similar to the original Fisher hypothesis, it appears that evidence on its inverted version is mixed.

The second variation on this theme is the so-called Mundell-Tobin effect (see Mundell (1963) and Tobin (1965)), which argues that real money balances decrease with increases in inflation, resulting in a fall in the real asset holding of agents. Therefore, agents increase their savings and the real interest rate decreases. As a result, a 1% increase in the inflation rate leads to a less than 1% increase in the nominal interest rate. Many authors used the idea of the Mundell–Tobin effect to justify the finding that the Fisher effect is less than one-for-one. For example, see Woodward (1992), Crowder and Hoffman (1996) and Coppock and Poitras (2000).
Finally, as originally formulated in the Fisher equation, the nominal interest rate that agents consider as the signal for deciding the level of their investment is the after-tax rate. Therefore, the effect of a change in the expected inflation rate on the before-tax nominal interest rate, which is frequently used in applied studies, could be greater than one. This theoretical argument was first suggested by Darby (1975) and Feldstein (1976). Following their theoretical argument, empirical studies were conducted. Although Peek (1981) strongly supported the Darby-Feldstein effect, most empirical studies, for example Tanzi (1980), Cargill (1977) and Carr, Pesando and Smith (1976), found that the Fisher effect was equal to or less than one, rejecting the Darby-Feldstein effect. Yun (1984) and Crowder and Wohar (1999), using both taxable and tax-exempt bond rates, found that the coefficient for the former rate was greater than that for the latter, supporting the Darby-Feldstein effect. As it is hard to distinguish one effect, such as the Darby-Feldstein effect, from others, such as the Mundell-Tobin effect, the evidence is mixed.

7. The Fisher Hypothesis in Japan

This section reviews the literature on testing the Fisher hypothesis in Japan in more detail. The literature on testing the Fisher hypothesis in Japan has grown rapidly since the late 1970s, when the inflation rate rose substantially and became quite volatile. Table 3 lists some of the key papers in the area and, once again, it seems sensible to divide these papers into three categories.

1. Papers that use the traditional methods of analysis to calculate the expected inflation rate using distributed lag models.
2. Papers that apply the testing methods suggested by Fama (1975) and Mishkin (1990a).
3. Papers that use ‘modern’ time series methods.
Table 3  The Results in the Tests on the Fisher Hypothesis in Japan

<table>
<thead>
<tr>
<th>Literature</th>
<th>Periods</th>
<th>Frequency</th>
<th>Interest Rate</th>
<th>Inflation Rate</th>
<th>Method</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oritani (1979)</td>
<td>1967-1978</td>
<td>Monthly</td>
<td>Short</td>
<td>WPI</td>
<td>Traditional</td>
<td>FE: Partial, Lags: within 2 years</td>
</tr>
<tr>
<td>Furukawa (1985)</td>
<td>1965-1982</td>
<td>Quarterly</td>
<td>Long &amp; Short</td>
<td>WPI, CPI, GNP deflator</td>
<td>Traditional</td>
<td>FE: Partial, Lags: within 2 years</td>
</tr>
<tr>
<td>Satake (2005a)</td>
<td>1971-2002</td>
<td>Quarterly</td>
<td>Short</td>
<td>CPI</td>
<td>COINT etc</td>
<td>FH: Not Supported</td>
</tr>
<tr>
<td>Satake (2005b)</td>
<td>1971-2002</td>
<td>Quarterly</td>
<td>Short</td>
<td>CPI</td>
<td>IRF with SB</td>
<td>FE: Partialal</td>
</tr>
</tbody>
</table>

(Notes)

a Interest rate is classified into two categories, i.e. Short and Long. 'Long' contains NTT coupon and Government bonds, and Short does Call, Gensaki and CD Rate.
b Expected means to use expected inflation rate derived from ARMA or Kalman filter model.
c Traditional is the approach using Distributed Lag Models. Fama and Mishkin is the approach using (6) and (7) respectively. COINT is Cointegration analysis. PVM is Present Value Model. SB is Structural Break. IRF is Impuls Respense Function. TAR is Thoreshold Autoregresion.
d FE is Fisher Effect, FH is the Fisher Hypothesis, and IFE is the inverted Fisher Effect. Lags is the lags of distributed lag models.
7.1 Literature Related to Monetary Policy Target: Traditional Testing Methods

Oritani (1979), Kama (1981), Miyagawa (1983) and Furukawa (1985) conducted Fisher hypothesis tests to discuss the potential role of an interest-rate target as a monetary policy objective and all use some variant of the ‘traditional’ method of testing the Fisher effect with some form of distributed lag to proxy for expected inflation. Oritani (1979) examines the magnitude of the Fisher effect to calculate the expected inflation rate using time series models as well as distributed lag models. The empirical work in this paper uses the three-month Gensaki\(^9\) rate as the nominal interest rate and the wholesale price index (WPI) as the price level for monthly Japanese data from February 1967 to December 1978. An Almon lag model with three degrees and 24-month lags is adopted. It was found that inflation fluctuation lags two years earlier affect current nominal interest rates. The estimation by the Koyck lag model indicates that the coefficient of the one-period nominal interest rate is 0.85 and that of the inflation rate is 0.17, therefore finding that the effect continues about two years and its size is less than one as same as the case of Almon lag model, so that the lag length of the effect is not as long as the result of Fisher (1930). In the analysis using ARMA models to estimate the expected inflation rate, Oritani (1979) found that the coefficient of the expected inflation rate was significant but less than 0.25, contrary to the result of 1.0 (for US data) in Feldstein, Summers et al. (1978).

Kama (1981), Miyagawa (1983) and Furukawa (1985) conducted the traditional approach of deriving the expected inflation rate from Almon lag models for almost the same period as Oritani (1979). They found that the lag length of the Almon lag models is less than three years, quite shorter than the evidence in Fisher (1930) and that the size of the Fisher effect is far less than one.

To test the Fisher effect, Kama (1981) estimated the Almon lag models using

\(^9\) Gensaki means repurchase agreements.
the return on NTT coupon bonds as the long-term interest rate, the call rate as the short-term interest rate and the WPI and CPI to calculate the inflation rate during the period from October 1967 to December 1978. The lag lengths of 18, 24 and 30 months and three or six polynomial degrees are adopted. The results are as follows: 1) as the significance of the coefficients of the lagged inflation rates disappeared by the thirtieth lag, it is considered that the inflation rate three years prior does not affect the nominal interest rate. Therefore, the effect from the long lag length as in Fisher (1930) could not be found. 2) The sum of the coefficients of lagged variables is far less than one, converted at the annual rate, indicating that the Fisher effect is partial. Moreover, 3) the lag length and the size of the Fisher effect in the case of WPI are larger than in the case of CPI and the lag length of the long-term interest rate is shorter than that of the short-term interest rate. As the serial correlation in the residual term is substantially high, Kama (1981) indicates the possibility of missing explanatory variables. Therefore, Kama (1981) conducted the estimation adding real income (to test the income effect) and real money supply (to test the liquidity effect) as regressors into the equations. It is found that 1) the coefficient of the real money supply is only significant in the case of the long-term interest rate and that 2) there is no difference in the effect of the expected inflation rate both with and without adding two other regressors.

Miyagawa (1983) conducted a test of the Fisher effect, estimating the Almon lag models with three polynomial degrees and thirty months of lag for monthly Japanese data. The monthly change rates of WPI and CPI were adopted as the inflation rate, the return on NTT coupon bonds were used as the long-term interest rate and the call rate was used as the short-term interest rate, similar to Kama (1981), between January 1969 and December 1978. Finding that the signs of the coefficients were all significantly positive and the coefficient of the determination was more than 0.9, Miyagawa (1983) insisted that the results show
evidence to support the Fisher hypothesis while not mentioning that the size of the effect, which considers the sum of the coefficients of the distributed lags converted at the annual rate, was far less than one. Although the coefficients of lag lengths up to thirty months are significant, a lagged inflation rate longer than thirty months does not affect the nominal interest rate. As described above, the result of Miyagawa (1981) was very similar to that of Kama (1981).

Furukawa (1985) conducted an estimation of the Fisher effect for quarterly Japanese data from 1965 to 1982 using the return on NTT coupon bonds as the long-term interest rate, the call rate and the Gensaki rate as short-term interest rates and the WPI, the CPI and the GNP deflator as price indices. The results are as follows. 1) The effect of the lags continues for one year in the case of the GNP deflator and for two years in the case of the WPI. It is shorter than that of Fisher (1930). 2) The sum of the lag coefficients is far less than one, indicating that the Fisher effect is incomplete. 3) The size of the sum of the coefficients is larger than the Gensaki rate, the call rate and the return on the NTT Bond, in that order. The effect of long-term interest rates is less than that of short-term interest rates. This result is consistent with Yohe and Karnosky (1969), Gibson (1970a, 1972) and Cargill and Meyer (1980). Furukawa (1985), as well as Kama (1981), conducted an estimation of the equation with real money supply and real income as additional regressors. He found that, compared with the estimation of the model without additional explanatory variables, 1) the sign conditions were both satisfied and the coefficient of determination rose, 2) the liquidity effect disappeared over a short period while the income effect was persistent and 3) the results with additional explanatory variables were not different from those without them, similar to Kama (1981).

Essentially then, the results in this section suggest that the size of the Fisher effect is less than one and that lag lengths of up to three years are required to
capture the impact of inflation.

7.2 Empirical Studies of the Fisher Hypothesis Using the Methods of Fama and Mishkin

Fama’s (1975) approach was adopted by Shimizu (1978), Tatsumi (1982), Kuroda (1982) and Yamada (1991). Fama (1975) estimated the regression of the nominal interest rate on the inflation rate in equation (6) and tested whether or not the coefficient \( \beta \) is one.

Shimizu (1978) was the first to apply Fama’s (1975) approach to Japanese data. Using the call rate as the short-term interest rate and the CPI as the price index, he found that 1) there is a serial correlation in the residual term, while the hypothesis \( \beta = 1 \) in equation (6) was not rejected and 2) the coefficient of the one-period lagged inflation rate was significant. Therefore, the efficiency in the call market was rejected.

Tatsumi (1982) also tested Fama’s (1975) efficient market hypothesis for whether the coefficient \( \beta \) in equation (6) is one by estimating the regression model of the nominal interest rate on the inflation rate using monthly Japanese data for the full and sub samples during the period from 1955 to 1975, with the call rate and the Gensaki rate as the short-term interest rate and the CPI and WPI as the inflation rate. The efficient market hypothesis was basically rejected and supported for the only period when interest rates moved freely. This did not support the Fisher hypothesis. However, as there are many cases in which the hypothesis \( \beta = 0 \) is rejected, we could construe that the nominal interest rate has partial information on future inflations.

Kuroda (1982) used quarterly Japanese data from 1977 to 1980, with government bond (listed, compounded, yield to maturity) returns as the long-term interest rate and the WPI as the inflation rate. Kuroda (1982) calculates the expected inflation
rate at each maturity according to the government bond return from forecasting values estimated by ARMA models. The examinations are grouped into three categories: 1) the time series data at each maturity, 2) the cross-sectional data at each forecasting period of the inflation rate and 3) the panel data congregating the time series and the cross section data. The results were as follows: 1) the size of the Fisher effect was between 0.3 and 0.4 in the panel data set and 2) in the case of the time series data, the results of the longer maturity show a larger Fisher effect, although the size at maturity during year nine was the largest at 0.77.

As described above, an examination of the hypothesis based on Fama’s (1975) approach suggests that the Fisher hypothesis and the efficient market hypothesis are not supported by short-term financial markets in Japan, contrary to most of the results for the US. The size of the Fisher effect in Japan is smaller than that in the US. Evidence shows that the efficient market hypothesis is supported for the period during which the interest rate was deregulated, but not supported for regulated periods. Therefore, the assertion that the short-term financial market in Japan was inefficient is basically true.

The interest rate, described above, was regulated for most of the period of the empirical studies in Japan. Yamada (1991) applied Fama’s (1975) approach to recent data when the interest rate was deregulated from May 1979 to January 1989, using the one- to twelve-month matured interest rate. He found that 1) the hypothesis $\beta = 0$ in equation (6) was rejected for one- to twelve-month interest rate maturities, indicating that the nominal interest rate contains information on the future inflation rate and 2) the hypothesis $\beta = 1$ was not rejected for shorter maturities, e.g. one month and three months, but was rejected for six and twelve month maturities. It is generally considered that the interest rate partially contains information on the future inflation rate, implying that the partial Fisher effect was detected in Japan.

Studies applying Mishkin’s (1990a) approach can be found in Japan in Yamada
(1991), the Bank of Japan (1994) and Ito (2005). Yamada (1991) estimated equation (7) to test the size of the coefficient of the spread of nominal interest rates for different maturities, for the period from May 1979 to January 1989. The results show that 1) the hypothesis $\beta = 0$ is rejected only in the case of the short-term spread in nominal interest rates from one month to three month and 2) the hypothesis $\beta = 1$ is rejected in all cases. Therefore, the Fisher hypothesis was not supported. However, it can be suggested that the nominal interest rate within a one-year maturity in Euro-Yen data partly contains the information on future inflation and not in the long term. Applying Mishkin’s (1990a) approach, the Bank of Japan (1994) also investigated whether the nominal interest rate spread can be an effective indicator for forecasting future inflation rates for the term structures of nominal interest rates from one month to ten years, including for maturities longer than two years. The result was that, in the case of the spread between the overnight call rate and the three-month Gensaki rate, both hypotheses $\beta = 0$ and $\beta = 1$ were rejected, suggesting that $0 < \beta < 1$. As described above, the Fisher hypothesis was not supported in the relationship between the term structure of nominal interest rates and the inflation rate spread in Japan. However, the results suggest that the term structure of nominal interest rates contains information on future inflation only for a very short-term.

Ito (2005) applied Mishkin’s (1990a) approach to the monthly Japanese data for the Euro-Yen LIBOR rate from one month to twelve months and the yen swap rate with two-year to seven-year maturity during the period from February 1990 to August 1999. Basically, the term structure was found to have information on future inflation in most of the term structures. The coefficient of determination in the estimation results for short-term relationships was noted to be lower and the higher the coefficient of determination approached a one-for one in the response to the inflation rate spread the longer the maturity becomes. The result in Ito (2005)
is different from those in Yamada (1991) and the Bank of Japan (1994) with respect to maturity.

7.3 Empirical Results from Time Series Analyses Testing in Japan

In accordance with the development of recent time series analyses, the testing method of the Fisher hypothesis was conducted mainly by cointegration analysis and the VAR (Vector Autoregression) approach. Studies in Japan were undertaken by Engsted (1995), Satake (1997), Kamae (1999), Ito (2005), Maki (2005) and Satake (2005a, 2005b, 2006).

Kamae (1999) applied the cointegration test by Engel and Granger’s (1987) method to monthly Japanese data from June 1977 to June 1995 to examine the Fisher hypothesis using the expected inflation rates derived from the time series model by the Kalman filter method. It was found that the Fisher hypothesis was supported in most cases.

Ito (2005) conducted the Engle and Granger cointegration test using monthly Japanese data for the one-month to ten-year nominal interest rate and the CPI in the 1990s. Ito (2005) supports the Fisher hypothesis, consistent with the results of Kamae (1999). However, the cointegration relationship does not hold for short-term maturities.

Satake (2005a) used quarterly Japanese data for the CPI and CD rates during the period from 1971 to 2002 and examined the Fisher hypothesis by using two cointegration tests, i.e. the Engle and Granger test and the Johansen (1988) test. The analysis was conducted for the full sample and the two subsamples after a high inflation period for oil shocks. As a result, there is no cointegration relationship between the nominal interest rate and the inflation rate in most cases, while the Fisher hypothesis was supported in some Johansen test cases, as opposed to Kamae (1999) and Ito (2005). This may be the result of the difference in the data and
the sample periods.

Engsted (1995) also applied the long-run Fisher hypothesis by testing the constraints on the present value model for Japan. He found that the long-term nominal interest rate reflects the long-term expected inflation rate using quarterly data for the long-term interest rate and CPI for the period from 1974 to 1992, suggesting that the Fisher hypothesis is supported. Satake (1997) examined the robustness of the results in Engsted (1995) using the WPI instead of the CPI in Japan. It was also suggested that the long-term nominal interest rate reflects the long-term expected inflation rate, while the parameters’ constraints on the present value model was not supported.

Recently, approaches considering structural breaks on time series analyses like unit root and cointegration tests were developed. In testing the Fisher hypothesis, two types of approaches were basically applied; one is the cointegration test in consideration of structural breaks and the other is to apply a nonlinear model to the analysis to take multiple regimes into account.

Using quarterly Japanese data for the period from 1971 to 2002, Satake (2005b) confirmed that the nominal interest rate and the inflation rate are trend-stationary with one structural break and applied the Malliaropulos’ (2000) approach to the data, removing the trends from the variables that considered the structural break to test the Fisher hypothesis. He found that the partial Fisher effect was detected. Maki (2005) implemented the cointegration test incorporating the nonlinear TAR (Threshold Autoregressive) model, which divided the period into two regimes, into the Japanese nominal interest rate and inflation rate and found the cointegration between the two and supported the Fisher hypothesis.

Subject to Choi’s (2002) method, Satake (2006) examined whether the Fisher hypothesis or the inverted Fisher hypothesis was supported by using the TAR model, which is the nonlinear model to divide the sample period into two regimes,
one in which the inflation rate was high and volatile and the other in which it was stable. Whether the Fisher hypothesis or the inverted Fisher hypothesis in each regime was supported was tested. Results showed that the partial Fisher and partial inverted Fisher effects are detected in each regime. It was also found that the inverted Fisher effect when the inflation rate is stable is larger than the estimate of the linear model.

The results described above can be summarized as follows. 1) The partial Fisher effect, which means that the increase in the expected inflation rate partially induces an increase in the nominal interest rate, was mainly detected. 2) few studies support the Fisher hypothesis in that a one-for-one relationship exists between the variables. However, 3) Kamae (1999) and Ito (2005) conducted the cointegration tests and found support for the Fisher hypothesis.

8. Summary of Test Results in Australia for the Fisher Hypothesis

There are several empirical studies on testing the Fisher hypothesis in Australia. The results are summarized in Table 4. In summary, the results from this set of papers seems to find evidence of a Fisher effect, with the hypothesis that $0 < \beta < 1$ in (6) is on the whole supported, while the hypothesis that $\beta = 1$ in (6), i.e. a ‘full’ Fisher effect, found little support in Australia. We should make three points on the existing literature in Australia.

First, although three of the studies in Australia insisted on rejecting the long run Fisher hypothesis, i.e. Carmichael and Stebbing (1983), Inder and Silvapulle (1993) and Engsted (1995), these results were interpreted as supportive of a partial Fisher effect. While Carmichael and Stebbing (1983) found the evidence supportive of the inverted Fisher hypothesis, Moazzami (1991) supported a partial Fisher effect using the same data as Carmichael and Stebbing (1983) with a unit root test and error correction models. Inder and Silvapulle (1993) showed that the real interest
rate decreases 0.5% in response to a 1% increase in inflation rate, concluding the rejection for the Fisher hypothesis. However, it is construable that a partial Fisher effect exists. Engsted (1995) tested the restriction of the Fisher hypothesis from the present value model, which is the test that $\beta = 1$. As the alternative hypothesis, $\beta \neq 1$ contains the possibility that $0 < \beta < 1$ in this test and we cannot reject a partial Fisher effect.

Second, although Atkins (1989) and Mishkin and Simon (1995) supported the Fisher hypothesis in the long run, Olekalns (1996, 2001) and Hawtrey (1997) found mixed evidence for the Fisher hypothesis within subperiods. They showed that the Fisher hypothesis is not supported in the period before financial deregulation in 1983, but supported after the deregulation. Therefore, financial liberalization makes the Fisher hypothesis supportive, although we mainly have evidence for a
partial Fisher effect.

Finally, using a cointegration test with consideration for a structural break, Silvapulle and Hewarathna (2002) stated that there was a structural break in the first quarter of 1980 and that the Fisher hypothesis is supported for all of the samples from 1968 to 1998.

As described above, the results for testing the long-run Fisher hypothesis are clear. Although in Olekalns (1996) and Hawtrey (1997), the hypothesis that $\beta = 1$ in (6) is only supported after the deregulation period, as well as the partial Fisher hypothesis that $0 < \beta < 1$ is almost supported, a recent study by Silvapulle and Hewarathna (2002) supported the Fisher hypothesis regardless of sample periods.

9. Summary of Test Results on the Fisher Hypothesis in Other Countries

9.1 Results for Other Developed (OECD) Countries

Table 5 summarizes some of the key papers essentially from OECD countries. The literature reviewed here is categorized into two techniques, i.e. Fama’s or Mishkin’s methods and time series analyses as unit root and cointegration tests and VAR models.

The main studies on developed (OECD) countries using regression analyses for Fama’s or Mishkin’s models are put forward by Caporale and Pitts (1998), Gerlach (1997), Jorion and Mishkin (1991), Koedijk and Kool (1995), Mishkin (1984) and Mishkin (1991), all which found evidence for a partial Fisher effect, except for Caporale and Pitts (1998), which insisted on rejecting the Fisher effect because of the rejection of the hypothesis $\beta = 1$ in (7).

Mishkin (1984) examined the Fisher hypothesis by testing the constancy of the real interest rate in the Euro deposit market using seven OECD quarterly data for the period from 1967 to 1979. Mishkin (1984) found that the constancy of real interest rates was rejected and a negative correlation between real interest
<table>
<thead>
<tr>
<th>Literature</th>
<th>Countries</th>
<th>Period</th>
<th>Frequency</th>
<th>Approach^a</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mishkin (1984)</td>
<td>OECD 7 countries</td>
<td>1967-1979</td>
<td>Quarterly</td>
<td>Regression of $\pi$ on Ex Ante $r$</td>
<td>FH: Not Supported, Rejected Constancy of $r$</td>
</tr>
</tbody>
</table>
rates and expected inflation appeared for all seven countries. This showed that short-term bonds are a poor inflation hedge not only in the US but also in other countries. Mishkin (1991) tested the forecastability of the term structure of interest rates on inflation in 10 OECD countries using equation (7) by Mishkin (1990a) and found evidence for a partial Fisher effect. In Gerlach (1997), Jorion and Mishkin (1991), Koedijk and Kool (1995) and Woodward (1992), the literature applying Mishkin’s method found evidence for a stronger Fisher effect for a longer maturity of government bonds for OECD countries, although Koedijk and Kool (1995) found weak evidence for the Fisher effect in Belgium, France and Germany. We have mixed evidence using Mishkin’s method, although by and large we obtained evidence for $0 < \beta < 1$, which is the coefficient for the size of the Fisher effect in equation (7).

The main studies on developed (OECD) countries using cointegration tests were put forward by Andrade and Clare (1994), Berment and Jelassi (2002), Choudhry

<table>
<thead>
<tr>
<th>Author</th>
<th>Country</th>
<th>Period</th>
<th>Data Frequency</th>
<th>Test Method</th>
<th>FH:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapach and Weber</td>
<td>OECD 16 Countries</td>
<td>1957-2000</td>
<td>Monthly</td>
<td>UNIT, COINT(Several)</td>
<td>$\pi \sim I(0)$, $R \sim I(1)$, FH: Not Supported</td>
</tr>
<tr>
<td>Yuhn (1996)</td>
<td>US, UK, Japan, German, Canada</td>
<td>1979(1982)-1993</td>
<td>Quarterly</td>
<td>COINT(JOH)</td>
<td>FH: Supported in the long run in the US, German and Japan</td>
</tr>
</tbody>
</table>

(Notes)
*a R is nominal interest rate, r is real interest and $\pi$ is inflation rate. Fama and Mishkin is the approach using (6) and (7) respectively. UNIT is unit root test, COINT is Cointegration analysis, EG is Engle and Granger Test, JOH is Johansen test, VECM is Vector Error Correction Model. PVM is Presen Value Model. TAR is Threshhold Autoregresion. ARDL Bound test is the same as Table 1.

*b R is nominal interest rate, r is real interest and $\pi$ is inflation rate. FE is Fisher Effect, FH is the Fisher Hypothesis, and IFH is Inverted Fisher Hypothesis.

The literature has several issues with respect to testing the Fisher hypothesis, i.e. monetary policy changes, a regime change for exchange rate systems and the initiation of the European Monetary Unit (EMU).

For the first issue, for example, Peng (1995) tested the Fisher hypothesis using Johansen cointegration test in the US, UK, France, Germany and Japan for the period between 1957 and 1994. He found strong evidence for the cointegration relationship between the nominal interest rate and inflation in the US, the UK and France, while there was weak evidence in Germany and Japan and guessed that the strong anti-inflation policy in Germany and Japan weakened the Fisher effect. On the other hand, Yuhn (1996) reported that the Fisher hypothesis was supported in the US, Germany and Japan, and not in the UK and Canada for the period from 1979 to 1993, and that the results were robust to policy changes, contrary to Mishkin (1992).

The second issue with respect to testing the Fisher hypothesis was whether the nature of the exchange rate regime used in countries impacted the empirical testing of the hypothesis. For example, MacDonald and Murphy (1989) analysed the Fisher hypothesis in the US, the UK, Canada and Belgium for the period from 1955 to 1986. Results indicated that the cointegration relationship was detected in the US and Canada for the period of the fixed exchange regime, but not in all countries with a floating exchange regime. The results for the US were consistent with Bonham (1991). It is conceivable that inflation was not constrained from monetary policy, although monetary policy was not free during the fixed exchange rate regime.

Finally, Nievas (1998) tested the Fisher hypothesis to examine the effects of the
initiation of the EMU in 1989 for the impact of the inflation rate and the German interest rate on the interest rate of other European countries. He found that the Fisher effect disappeared in the three countries after initiation, while German interest rates affect the interest rates of other EU countries because interest rates in EU countries are controlled by German monetary policy.

With respect to other studies using modern time series analyses, as shown in Table 5, mixed evidence exists and it is very hard to find a clear message. As we have referred to these papers in Section 5, when reviewing them in the US, we do not argue about it.

9.2 Results for Other Developing Countries

A number of studies test the Fisher hypothesis in developing countries. Table 6 summarizes some of the key papers that essentially come from Latin American and South-East Asian economies.

Most Latin American countries experienced high inflation and, therefore, as might be expected we have clearer evidence that the Fisher hypothesis is supported. Tests that rely on the cointegration framework tend to find evidence of a common trend in nominal interest rates and inflation rates, where interest rates adjusting promptly to keep real interest rates constant in response to high and volatile inflation. The literature on Latin America includes papers by Boschen and Newman (1987), Carneiro, Divino and Rocha (2003), Choudhly (2001), Garcia (1993), Mendoza (1992), Phylaktis and Blake (1993) and Thornton (1996). Berument and Jelassi (2002) test the Fisher hypothesis in a cross-section of 26 countries containing six Latin American countries and Kasman, Kasman and Turgutlu (2006) tested 19 developing countries, which included seven Latin American countries.

Phylaktis and Blake (1993) examined the Fisher hypothesis for three Latin American countries, i.e. Argentina, Brazil and Mexico, using monthly data from the
Table 6  The Literature on Testing the Fisher Hypothesis in Developing Countries

| Literature                        | Countries                          | Period      | Frequency | Approach\(^a\) | Results\(^b\)
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Berument and Jelassi (2002)</td>
<td>26 Countries</td>
<td>1970s-1990s</td>
<td>Quarterly</td>
<td>UNIT, COINT(JOH), ECM</td>
<td>FH: Supported in all countries, Developing Countries</td>
</tr>
<tr>
<td>Carneiro, Divino and Rocha (2002)</td>
<td>Argentina, Brazil, Mexico</td>
<td>1980-1997</td>
<td>Monthly</td>
<td>COINT(JOH)</td>
<td>FH: Supported in Argentina and Brazil, Not in Mexico</td>
</tr>
<tr>
<td>Garcia (1993)</td>
<td>Brazil</td>
<td>1973-1990</td>
<td>Monthly</td>
<td>Regression of E (\pi) &amp; (R) on (r)</td>
<td>FH: Supported</td>
</tr>
<tr>
<td>Phylaktis and Blake (1993)</td>
<td>Argentina, Brazil, Mexico</td>
<td>1970s-1990s</td>
<td>Quarterly</td>
<td>UNIT, COINT(JOH), ECM</td>
<td>FH: Supported in all countries</td>
</tr>
</tbody>
</table>

(Notes)

\(^a\) UNIT is Unit Root Test, COINT is Cointegration test, EG is Engle and Granger Test, JOH is Johansen test, ECM is Error Correction Model. R is nominal interest rate, \(r\) is real interest and \(\pi\) is inflation rate. AE is Adaptive Expectations, and RE is Rational Expectations.

\(^b\) FH is the Fisher Hypothesis, which is a one-for-one long-run relationship between R and \(\pi\). FE is the Fisher effect, whose size is classified into full, partial and non. 'full' means the support for the Fisher hypothesis.

1970s and 1980s. Using the unit root and cointegration tests, Phylaktis and Blake
(1993) found a long-run relationship between nominal interest rates and inflation in the three countries, supporting the Fisher hypothesis.

Berument and Jelassi (2002) applied cointegration regression to six Latin American countries and found that the Fisher hypothesis was supported in four out of the six, i.e. Chile, Mexico, Uruguay and Venezuela and but not Brazil and Costa Rica. Kasman, Kasman and Turgutlu (2006) use the fractional cointegration test, which allowed for the time series property subject to I\((d)\), where \(0 < d < 1\) and tends to support the Fisher hypothesis. They obtained supportive evidence for all countries except for Costa Rica. Other supportive evidence can be found in Garcia (1993) for Brazil, in Mendoza (1992) for Chile and in Thornton (1996) for Mexico. Mixed evidence can be found in Carneiro, Divino and Rocha (2003), who conducted Johansen’s cointegration test and found that the Fisher hypothesis is supported for Argentina and Brazil but not for Mexico and in Choudhly (2001), who used stock returns to find evidence supporting Argentina and Chile but not Mexico and Venezuela. Boschen and Newman (1987) applied regression analysis of expected inflation on real interest rates derived from indexed bonds to Argentina data and found a negative relationship between real interest rates and inflation, insisting a rejection of the Fisher hypothesis.

Payne and Ewing (1997) conducted unit root and cointegration tests for nine developing countries, including six Asian countries, i.e. India, Malaysia, Pakistan, Singapore, Sri Lanka and Thailand. They found cointegration relationships in Malaysia, Pakistan, Singapore and Sri Lanka and supported the Fisher relation in these countries except for Singapore. Berument and Jelassi (2002) conducted a Fisher hypothesis test in four Asian countries, i.e. India, Kuwait, the Philippines and Turkey and found supportive evidence in Turkey. Kasman, Kasman and Turgutlu (2006) conducted the test in eight Asian countries, i.e. China, India, Indonesia, Malaysia, Pakistan, the Philippines, Thailand and Turkey and found
nonsupportive evidence only in Malaysia and the Philippines. Cooray (2002) applied cointegration analysis and regression on expected inflation derived from adaptive and rational expectations of nominal interest rates to Sri Lanka and found weak evidence to support the Fisher hypothesis, as opposed to the evidence of Payne and Ewing (1997). Kutan and Askoy (2003) conducted a Fisher hypothesis test using stock returns as the nominal interest rate in Turkey and found limited support using financial sector returns. Kandel, Ofer and Sarig (1996) examined the relationship between ex ante real interest rates derived from bond prices on expected inflation and found a negative relationship between them, insisting that weak evidence existed on the Fisher effect. In Asian countries, a Fisherian relationship is, as in most developed economies, inconclusive.

10. Conclusions

This paper provided a brief review of the literature pertaining to the empirical tests of the Fisher hypothesis. For convenience, the survey of the literature in the US, Australia, Japan and the rest of the world was divided into three parts, each pertaining to a different general testing methodology, including:

• The ‘traditional’ approach, which Fisher (1930) originally suggested and which formed the basis for much of the initial work.
• Tests based on the methods suggested by two seminal papers, those of Fama (1975) and Mishkin (1990a).
• Tests based on ‘modern’ time series methods associated with unit root and cointegration tests.

Drawing conclusions from such diverse literature is difficult. However, some general conclusions can be drawn.

Fisher’s original results have not held up to the scrutiny of further empirical
work. Few studies find evidence in favour of the ‘strong form’ of the Fisher hypothesis with an adjustment in interest rates and inflation being one-for-one. In following Fisher, a number of authors found that after inflation rates started to increase and became more persistent in the late 1960s, the distributed lag structure that Fisher found to be rather lengthy began to shorten, suggesting that agents were building in inflationary expectations more rapidly as the costs of inflation rose. In the second wave of the literature, applying the Fama and Mishkin approaches, the focus of the testing became whether the Fisher effect was full, partial, or zero. Although the evidence is mixed in that it differs from period to period and from country to country, it is conceivable that the evidence is, by and large, in favour of a partial Fisher effect. Finally, the literature applying time series analysis also shows mixed evidence. Tests using Johansen's cointegration approach tend to find some support for the hypothesis in the US, in particular that evidence is stronger in cases in which the research considers the impact of structural breaks and in the application of nonlinear models to detect structural changes.

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Testing the Fisher Hypothesis: A Survey of Empirical Studies (Mitsuhiko Satake) (479) 111


Abstract


This paper provides a brief review of the literature pertaining to the empirical tests of the Fisher hypothesis. The survey of the literature in the US, Japan, Australia, and the rest of the world has been divided into three parts, each pertaining to a different general testing methodology. These include (1) the “traditional” approach, which was originally suggested by Fisher (1930) and was the basis of much of the initial works; (2) tests based on the methods suggested by the seminal papers of Fama (1975) and Mishkin (1990a); and (3) tests based on “modern” time series methods associated with unit root and co-integration tests.