

# **THE FISHER EFFECT: A REVIEW OF THE LITERATURE**

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## **Abstract**

The Fisher hypothesis has been a much debated topic. Over the years the hypothesis debated and the techniques used have changed. While the majority of early studies on the Fisher effect concentrated primarily on confirming the long and distributed lag in expectations formation, subsequent work saw the integration of the Fisher hypothesis with the theories of rational expectations and efficient markets. With the incorporation of these theories in the Fisher hypothesis, the methodological advances involved examining the time series properties of the variables in question. This survey reviews previous work from this perspective. In addition, the studies pertaining to developing economies and possible explanations for the failure of the Fisher effect are also reviewed.

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## *I Introduction*

The relationship between interest rates and inflation, first put forward by Fisher (1930), postulates that the nominal interest rate in any period is equal to the sum of the real interest rate and the expected rate of inflation. This is termed the Fisher Effect. Fisher (1930) hypothesized that the nominal interest rate could be decomposed into two components, a real rate plus an expected inflation rate. He claimed a one-to-one relationship between inflation and interest rates in a world of perfect foresight, with real interest rates being unrelated to the expected rate of inflation and determined entirely by the real factors in an economy, such as the productivity of capital and investor time preference. This is an important prediction of the Fisher Hypothesis for, if real interest rates are related to the expected rate of inflation, changes in the real rate will not lead to full adjustment in nominal rates in response to expected inflation.

A problem that arises when testing for the Fisher effect is the lack of any direct measure of inflationary expectations. For this reason, a proxy variable for inflationary expectations must be employed. Over the years, a number of approaches have been used to derive proxies for the expected rate of inflation. The majority of early studies on the Fisher effect used some form of distributed lag on past inflation rates to proxy for inflationary expectations. Models based upon this approach can be found in Cagan (1956), Meiselman (1962), Sargent (1969) and Gibson (1970). With the theory of rational expectations pioneered by Muth (1961), and the theory of efficient markets advanced by Fama (1970), there developed an alternative approach to modeling expectations. Subsequent studies, therefore, saw the incorporation of rational expectations in the formation of expectations. This approach is adopted by Fama (1975), Lahiri and Lee (1979), and Levi and Makin (1979). With the

incorporation of these theories in the Fisher hypothesis, methodological advances involved examining the time series properties of the variables in question. See Mishkin (1992), Wallace and Warner (1993), MacDonald and Murphy (1989), Peng (1995).

The paper is structured as follows. Section II examines Fisher's own conclusions; the early literature that concentrated primarily on verifying Fisher's results; subsequent work which saw the integration of the Fisher hypothesis with the theories of rational expectations put forward by Muth (1961) and efficient markets developed by Fama (1970); and the methodological advances which involved examining the time series properties of the variables in question. Section III examines the literature pertaining to less developed countries. Section IV examines the possible explanations that have been put forward in an attempt to reconcile the contradictory results obtained in respect of the Fisher effect. Section V summarizes the conclusions.

## *II Models of Expectations Formation*

### *(i) Fisher's Findings*

Fisher (1930) hypothesized that the nominal rate of interest was equal to the sum of both the real rate of interest and the expected rate of inflation. He claimed a one-to-one relationship between the rate of interest and expected inflation, with the real rate being independent of the rate of inflation.

Assuming that inflationary expectations were formed on the basis of a distributed lag structure, Fisher (1930) examined the relationship between nominal interest rates and the rate of inflation for the U.S and the U.K. Using annual data over the 1890–1927

period for the US, and 1820–1924 period for the U.K, Fisher found that inflationary expectations were not instantaneously reflected in interest rates. For the US, the highest correlation, 0.86, between long-term interest rates and price changes was obtained when the latter was lagged over 20 years, while for the UK, a correlation coefficient of 0.98 was obtained when price changes were spread over 28 years. A study of short-term commercial paper rates in relation to quarterly price movements for the US further corroborated the evidence from correlating long-term interest rates and price changes. Thus, Fisher (1930, p.451) concluded:

We have found evidence general and specific ... 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 rates 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.<sup>1</sup>

This subsequently led to a voluminous literature in an attempt to reconcile Fisher's findings with the theory. The following section will review some of these studies.

### *(ii) Adaptive Expectations*

The work of Sargent (1969), Gibson (1970), Yohe and Karnosky (1969), Lahiri (1976) concentrated primarily on verifying Fisher's results with respect to the existence of a distributed lag structure in expectations formation. While adopting the basic distributed lag mechanism as that of Fisher in the formation of expectations, the specifications involving the lagged variables differed from the arithmetically declining weights as originally proposed by Fisher. Sargent (1969) and Gibson (1970) employed geometrically declining weights,<sup>2</sup> while Yohe and Karnosky (1969)

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<sup>1</sup> This provided an explanation of the "Gibson Paradox" which was the high correlation observed between the price level and interest rates during the pre-World War II period.

<sup>2</sup> Also known as the Koyck lag, originally proposed by Koyck (1954).

used the Almon lag technique<sup>3</sup> in order to avoid problems of multicollinearity. The studies of Sargent and Gibson, based on data from the pre-war period, confirmed Fisher's findings of a significant distributed lag effect in expectations formation. Gibson, moreover, observed that there appeared to be a cyclical factor in the formation of price expectations, suggestive of a higher-order weighting pattern for past price changes. An important implication that emerged from his study was that policy action designed to influence interest rates would eventually be felt on price expectations.

From the 1960s, there was significant evidence of a shortening of the time lag in expectations formation, as suggested by the studies by Yohe and Karnosky (1969), Gibson (1972) and Lahiri (1976). Yohe and Karnosky found an acceleration in the speed of expectations formation, with the price expectation effect much greater for the 1961–1969 period than the 1952–1960 period. Gibson (1972) similarly observed that there was almost a point-for-point adjustment in nominal interest rates to changes in inflation during the 1959–1970 period, with a time lag of about six months. The results revealed a shorter lag in the formation of expectations and greater impact of expectations on interest rates for the period after 1959, supporting the evidence of Yohe and Karnosky. Lahiri, employing four approaches to estimate inflationary expectations—the weighted, adaptive, extrapolative, and Frenkel's approach—found that expectations were forming more rapidly in the period after 1960, consistent with the findings of Yohe and Karnosky and Gibson.

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<sup>3</sup> Put forward by Almon (1965), where  $\beta_i$  follows a polynomial of degree  $r$  in  $i$ .

Gibson's (1972) model, however, differs in its use of data. To overcome the problem of systematic forecasting errors produced by backward-looking models of expectations formation, Gibson employed survey data published by the Federal Reserve Bank of Philadelphia. While the structural break observed in the 1960s was attributed by Yohe and Karnosky to a shift in the interest rates equation, Gibson suggested the possibility of a shift in the formation of the price expectations equation. Lahiri's findings appeared to support that of Gibson. Therefore, a positive relation between interest rates and inflation with a significant shortening of the time lag in expectations formation from the 1960s onwards is evidenced by these studies. Moreover, the Fisher hypothesis took a different turn during this period in that it began to be integrated with the theories of rational expectations and efficient markets.

*(iii) Rational Expectations and Efficient Markets*

The crux of the argument changed with the incorporation of the theories of rational expectations put forward by Muth (1961) and efficient markets developed by Fama (1970) in the Fisher hypothesis. While Fisher argued that past changes in the price level became embodied in the current rate of interest, Fama (1975) argued that future price changes were reflected in the current rate of interest. This was interpreted by him as evidence of an efficient market. Fama's study, therefore, differed from the models discussed above in its analysis of inflationary expectations. This approach rejected Fisher's conclusions of a distributed lag structure in the formation of expectations. Instead, it assumed that rational forecasters would use all available information in forming price expectations.

Using data for one-month Treasury bills to approximate interest rates and the rate of change in the consumer price index to approximate price changes, he tested the joint hypothesis that the U.S Government Treasury bill market was efficient and that the real return on one-to-six month Treasury bill was constant within a rational expectations framework. Fama computed sample autocorrelations of the expected change in purchasing power and real return for lags from 1–12 for the period January 1953 to July 1971. The estimated sample autocorrelations of  $\pi_t$  were large, indicating that past rates of change in  $\pi_t$  contained information about expected future rates of change. The sample autocorrelations of the real return were insignificantly different from zero, consistent with the hypothesis of a constant real return. Tests were also carried out for longer-term maturities for up to six months. Results for all maturities indicated that the market used all the available information about the rate of inflation in setting nominal rates of interest, thus supporting the efficient market hypothesis.

Fama's findings were subsequently challenged by Hess and Bicksler (1975), Carlson (1977), Joines (1977), and Nelson and Schwert (1977). Carlson (1977), using Livingston data on the CPI for the period 1953–1971, rejected Fama's findings that short-term interest rates were efficient predictors of subsequent rates of inflation. Carlson introduced a business cycle variable to Fama's regression equation which was represented by the ratio of employment to population, lagged by six months. With the incorporation of this variable, the coefficient on the interest rate in Fama's model was found to deviate significantly, which led Carlson to conclude that information about inflation that was not fully incorporated in interest rates was reflected in this ratio. Joines (1977) observed a seasonal pattern in the forecast errors of the rate of price inflation used by Fama which he pointed out was inconsistent with the concept of

market efficiency leading him to question the accuracy of the price data used by Fama. Nelson and Schwert (1977) and Hess and Bicksler (1975) employed a Box-Jenkins approach to construct a time series predictor of inflation, based on past rates of inflation. The regression of the rate of inflation on the rate of interest and the estimated rate of inflation yielded a non-zero coefficient for estimated inflation, indicating that the forecaster contained information about the rate of inflation not embodied in the rate of interest.

With the incorporation of rational expectations and efficient markets in the Fisher hypothesis literature, it was believed that the time series in question should approximate a random walk in an efficient market. The random-walk model requires that changes in past rates of inflation and interest rates be uncorrelated with all prior information. This was in sharp contrast to the distributed lag effect in expectations formation which implied that inflation rates were highly and positively correlated. Although the studies of Hess and Bicksler (1975), Carlson (1977), Fama and Gibbons (1982) suggested that when expected real returns were assumed to display a unit root, Treasury bill rates were good predictors of inflation, no explicit tests for unit roots were carried out by them.

Mishkin (1992), in an attempt to explain why there was strong evidence of a Fisher effect for some periods and not for others, pointed out that a Fisher effect would only appear in samples where inflation and interest rates displayed stochastic trends. The reasoning behind this was that when the two series exhibit trends, they would trend together, resulting in a strong correlation between them. This involved determining

the univariate statistical properties of the respective time series, namely, inflation and interest rates.

Using monthly data from January 1953 through to December 1990, and the Dickey Fuller and Phillips tests for unit roots, he observed that both the levels of inflation and interest rates contained a unit root. Cointegration tests for a common trend in inflation and interest rates revealed the existence of a long-run Fisher effect, however the absence of a short-run relationship. As predicted, a Fisher effect was observed for the post-war period until October 1979 in which evidence was strongest of stochastic trends in inflation and interests rates. There was no evidence of a trend and therefore a Fisher effect for the pre-war period and October 1979 to September 1982.

Studies by Bonham (1991), Jacques (1995) and Wallace and Warner (1993), covering a similar time period, confirmed Mishkin's findings that inflation contained a unit root. Using an expectations model of the term structure, Wallace and Warner (1993) examined the effects of inflation on long as well as short-term interest rates. Applying the Johansen and Juselius (1990) cointegration test to quarterly data from 1948.1–1990.4, they found interest and inflation rates to be I(1) processes in the majority of cases. Cointegration tests provided support for both the Fisher relationship in the short and long term, and the expectations theory of the term structure. They could not reject the point-for-point relationship between interest rates and inflation as postulated by Fisher. Bonham (1991), applying the Dickey Fuller test to monthly data from 1955.1–1990.3, found results to be consistent with those of Wallace and Warner (1993). Results provided support for stationarity in the first differences while the null hypothesis of no cointegration could not be rejected at the

5% level for the 1955.1–1986.1 period. Pelaez (1995) tested the Fisher relationship, using both the Engle Granger two-step procedure and Johansen's vector autoregressive error correction mechanism, for the period 1959.1–1993.4. Although results appeared to corroborate previous evidence, with both the rates of interest and inflation displaying unit roots, there was no evidence of a Fisher relationship. This was attributed to the random-walk effect displayed by the ex ante real rate.

In contrast, Rose (1988) found inflation to be a  $I(0)$  series and interest rates to be a  $I(1)$  series. Using annual data for the US for two sample periods, 1892–1970 and 1901–1950, he discovered that the null hypothesis of a unit root was rejected for inflation.<sup>4</sup> For further verification of results, he also used quarterly data from eighteen OECD countries. The null hypothesis of a unit root was rejected at the 5% level for all eighteen countries, lending support to the results from the annual data on the US. He obtained the same result with monthly data for the US for the 1947.1–1986.6 period, except for the period following the monetary policy change in October 1979. He concluded that others too—Huizinga and Mishkin (1984)—had found a structural break at this point. As opposed to Rose, Jaques (1995) observed that the interest rate spread contained distinctly different statistical properties from the rate of inflation. Using monthly observations from 1958.12–1991.12, he found inflation to be a  $I(1)$  series, while the interest rate spread appeared to be a  $I(0)$  series.

Hence, while the majority of studies on the US appear to suggest a positive relationship between interests rates and inflation, they do not establish a one-to-one

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<sup>4</sup> Four measures of prices, the GNP deflator, consumer price index, implicit price deflator, and wholesale price index and two measures of nominal interest rates, yield on high-grade corporate bonds and short term commercial paper rate were used for this purpose.

relationship as postulated by Fisher. It is useful, therefore, to examine if similar results have been obtained in respect of the Fisher relationship for other countries.

Studies on the Fisher effect for samples of OECD countries have been undertaken by Mishkin (1984), Peng (1995) and MacDonald and Murphy (1989). Mishkin (1984), studying real interest rate movements in seven OECD countries for the period 1967.2–1979.2 in the euro deposit market, found a close relationship between nominal interest rates and expected rates of inflation for the UK, the US and Canada. He found, however, that Germany, the Netherlands and Switzerland exhibited a much weaker Fisher effect. Consistent with the results obtained by Mishkin, Peng (1995) found a long-run relationship between interest rates and expected inflation for France, the U.K and the U.S for the 1957–1994 period, using the Johansen (1988) and Johansen and Juselius (1990) methodology. Expected inflation was found to have a much weaker impact on interest rates in Germany and Japan. Peng noted that inflation persistence was sensitive to the degree of monetary accommodation, leading to the observation of cointegration between inflation and interest rates over time. He concluded that the strong anti-inflationary policies pursued by the monetary authorities in Germany and Japan had led to less persistent inflation and hence a weaker Fisher effect. Similarly, MacDonald and Murphy (1989) found evidence of a Fisher relationship for the US, Belgium, Canada and the U.K for the period 1955 to 1986. They discovered that the null hypothesis of no cointegration could not be rejected for all countries for the entire sample period, indicating the existence of the Fisher relationship. When the sample was divided into fixed and floating exchange rate regimes, however, some evidence of cointegration was observed for the US and

Canada during the fixed exchange rate regime. There was no evidence of cointegration for any of the countries under the floating exchange rate regime.

Contrary to the findings of Peng, and MacDonald and Murphy, Yuhn (1996) found evidence of a Fisher effect for the US, Germany and Japan, but little evidence of it for the U.K and Canada. Results also pointed to the fact that the Fisher effect was not robust to policy changes. As opposed to the results obtained by Mishkin (1992), evidence pointed to a strong Fisher relationship for the 1979.4–1993.2 period, while there was no evidence of a Fisher effect for the 1982.4–1993.2 period. Dutt and Ghosh (1995), examining the validity of the Fisher theorem under fixed and floating exchange regimes for Canada, found no support for the Fisher effect for Canada, as did Yuhn.

Tests on the Fisher effect for Australia can be found in Mishkin and Simon (1995), Atkins (1989), Olekalns (1996), Hawtrey (1997) and Inder and Silvapulle (1993). Unlike in the case of the US, where results appear to be broadly consistent, results for Australia appear to be mixed with only weak evidence in support of a Fisher effect. Mishkin and Simon (1995), using data spanning the period 1962.3–1993.4, found evidence of a long-run Fisher relationship; however, the absence of a short-run effect. Atkins (1989), employing the post-tax nominal bill rate as the dependent variable for Australia, came up with results consistent with the Fisher equation, while Olekalns (1996), using pooled data for the pre- and post-deregulation periods, found only partial adjustment of the interest rate to changes in inflationary expectations. Complete adjustment was found to obtain with the use of only post-deregulation data. Money-supply shocks which affected the real rate were seen as an impediment to full

adjustment prior to deregulation. In a similar vein, Hawtrey (1997), using the Johansen methodology, found that there was no evidence of a Fisher effect before financial deregulation, while after deregulation there was evidence of one. Inder and Silvapulle (1993) using the ex post real bill rate as the dependent variable, found that results were inconsistent with the Fisher hypothesis. Thus, while evidence for the US seems to be broadly consistent with suggestion of a Fisher effect, results for other developed nations are not so clear-cut.

### *III Empirical Work for Developing Countries*

Empirical work on the Fisher effect for developing countries is sparse. The limited evidence that has accumulated in respect of developing countries is briefly reviewed in this section. Empirical studies on the Fisher effect for the Latin American countries have been undertaken by Phylaktis and Blake (1993), Garcia (1993), Thornton (1996) and Mendoza (1992). An interesting conclusion that emerges from these studies is the consistency in results with significant evidence of a Fisher effect. The same degree of consistency is not observed in respect of other developing countries.

Phylaktis and Blake (1993) examined the Fisher effect for three high-inflation economies, namely Argentina, Brazil and Mexico, for the 1970s and 1980s decades. Addressing the specific issue of whether there existed a long-run Fisher relationship, using the techniques of unit roots and cointegration, they found that there existed a long-run unit proportional relationship between nominal interest rates and inflation for the three countries reviewed. They noted that the results were in contrast to the mixed evidence obtained for low-inflation economies, suggesting that agents in high-

inflation economies tended to invest more in inflation forecasts and hence have greater incentive to incorporate inflationary expectations in yield returns. Comparing the speed of adjustment of interest rates to unanticipated inflation of these three countries with that of Australia and the US, they found that the high-inflation economies took longer to adjust. However, for all countries, it was found that the speed of adjustment was not a function of the absolute level of inflation or inflation rate volatility. Similarly, Garcia (1993), examining the Fisher effect for Brazil for the period 1973–1990, using interest rate data on non-indexed certificates of deposit from a sample of Brazillian banks, found that data was consistent with the Fisher hypothesis. Inflationary expectations were found to explain 99% of the movement in nominal interest rates. Thornton (1996), investigating the existence of a Fisher effect between Treasury bill rates and inflation in Mexico for the period 1978–1994, using unit root and cointegration techniques, found that results were broadly consistent with those of Phylaktis and Blake. The likelihood ratio statistic for  $\beta=1$  could not be rejected at the 5% level, consistent with the existence of a Fisher effect. Mendoza (1992), investigating the Fisher effect in the context of the of partial financial indexation mechanism currently operating in Chile, found evidence in support of it. Results showed that indexation facilitated financial intermediation in an inflationary environment and did not necessarily lead to interest rates higher than under a system absent of indexation. Despite the fact that these studies employ different structures, evidence appears to lend strong support for the Fisher hypothesis.

The same degree of support is not found in studies with respect to other developing countries. Kim (1989), Ham and Choi (1991), and Nam (1993) evaluated the Fisher relationship for Korea. Using data from 1974.1–1991.2 and vector autoregressive

techniques, Nam found that the liquidity effect dominated the Fisher effect in the long run. These results contrasted with previous findings by Kim and Ham and Choi, who reported that the Fisher effect dominated the liquidity effect. Zilberfarb (1989), employing survey data for the 1980.1–1988.2 period, examined the significance of the liquidity effect, unanticipated inflation and supply shocks in interest rate determination for Israel. He concluded the liquidity effect and unanticipated inflation had a negative impact on interest rates, while supply shocks had a positive effect on interest rates.

Employing the Johansen (1988) and Johansen and Juselius (1990) procedure, Payne and Ewing (1997) evaluated the Fisher effect for nine developing countries. Unit root tests revealed that interest rates and inflation were integrated of order one for all countries. The Johansen and Juselius cointegration approach indicated the presence of a long-run relationship between nominal interest rates and inflation for Sri Lanka, Malaysia Singapore and Pakistan. A unit proportional relationship was found for Malaysia, Sri Lanka and Pakistan, while there was no evidence of a Fisher effect for Argentina, Fiji, India, Niger and Thailand.

#### *IV Deviations from the Fisher Hypothesis*

Despite the positive relationship observed between interest rates and inflation, the majority of empirical studies have not conformed to the Fisher hypothesis in its strictest form. A number of possible explanations have been put forward in an attempt to reconcile the contradictory results obtained in respect of the Fisher hypothesis.

Theoretical justification for the partial adjustment was provided by Mundell (1963) and Tobin (1965) in terms of a “wealth effect”, and Darby (1975) and Feldstein (1976) in terms of a “tax effect”. Empirical justification was provided by Mishkin (1984) and Pelaez (1995), among others, in terms of a random-walk effect displayed by the ex ante real rate. An alternative explanation, based on the work of Tobin (1965) and Keynes (1936), was put forward by Carmichael and Stebbing (1983), which stated that the nominal rate remained constant with the real rate of interest moving inversely one-for-one with the rate of inflation. These arguments are briefly reviewed below.

Mundell (1963) and Tobin (1965) demonstrated that the nominal interest rate would rise by less than unity in response to a change in inflation through the impact inflation had on the real rate. This implied that inflation led to a fall in real money balances and the resulting decline in wealth led to increased savings bringing downward pressure on real rates. The adjustment in nominal interest rates would therefore be less than one for one with the expected rate of inflation. Empirical support for the Mundell-Tobin effect can be found in Woodward (1992) for shorter-term maturities in the U.K indexed bonds market.

An alternative argument was put forward by Darby (1975) and Feldstein (1976), who declared that in the presence of taxes on interest income, nominal interest rates would rise by more than unity in response to expected inflation for a given after-tax real rate of interest. The nominal interest rate was predicted to rise at a rate of  $1/(1-t)$  where  $t$  was a proportional tax rate on interest income. This argument, however, has had limited success in explaining actual interest rate movements—see Tanzi (1980),

Cargill (1977), Carr, Pesando and Smith (1976). The Darby-Feldstein explanation was subsequently modified by Nielson (1981) and Gandolfi (1982) to incorporate capital gains taxation. They found that, while the nominal interest rates rose by more than unity in response to a change in the rate of inflation, it was not as high as that suggested by Darby and Feldstein. In contrast, Peek (1982) found strong evidence in support of a tax-adjusted Fisher effect.

A number of recent studies—Mishkin (1984), Rose (1988), Pelaez (1995)—attribute the rejection of the Fisher effect to the non-stationarity of the *ex ante* real rate. Mishkin (1984), examining real interest rate behaviour in a sample of OECD countries for the 1967.2–1979.2 period, found that the constancy of the real rate was rejected for all seven countries studied. Pelaez (1995), examining a longer time period from 1959.1 to 1993.4, came up with similar results for the US.

An alternative argument is put forward by Carmichael and Stebbing (1983) by what they termed an ‘inverted’ Fisher effect. According to them, given a certain degree of regulation in the financial market and high degree of substitution between regulated and non-regulated financial assets, they argue that the after tax nominal rate of interest would remain approximately constant while the after-tax real rate would move inversely one for one with the rate of inflation. This was subsequently tested by Amsler (1986) and Graham (1988) for the US, and Choudhry (1997) for Belgium, France and Germany. While Graham, using the same time period as Carmichael and Stebbing, found that evidence clearly rejected the Fisher inversion, Amslers tests failed to reject the inverted Fisher hypothesis. Graham, however, found strong evidence in favour of a partial adjustment effect. Choudhry, employing a longer time

period, ranging from 1955–1994, found some support for a partial adjustment, nonetheless, little support for a Fisher inversion. Therefore, evidence with respect to the inverted Fisher hypothesis has not been clear-cut.

While the importance of taxes in the Fisher effect was previously highlighted in the work of Darby (1975), the empirical literature has not lent much support for the Darby hypothesis. This has been explained by way of fiscal illusion, tax evasion, tax exempt agents - see Tanzi (1980). Peek (1982) however, finds strong evidence supporting the inclusion of income tax effects in the Fisher effect. In comparing tax-adjusted and non-tax-adjusted versions of the Fisher equation he finds that while the tax-adjusted version of the Fisher effect does not get rejected, the non-tax-adjusted version is rejected in four of the six equations tested. The evidence relating to the role of taxes in the Fisher effect although has not been consistent is nevertheless important.

#### *V Conclusion*

This paper surveys the literature pertaining to the Fisher effect. While the majority of early studies on the Fisher effect confirm Fisher's findings of a distributed lag structure in expectations formation, the evidence in respect of the models based upon the theories of rational expectations and efficient markets is mixed. Although studies for the US appear to suggest a positive relationship between interests rates and inflation, they do not establish a one-to-one relationship as postulated by Fisher. However, the evidence for the US seems to be broadly consistent with suggestion of a Fisher effect, while results for other developed nations are not so clear-cut.

Studies for the developing nations suggest a high degree of consistency in results for the Latin American countries with significant evidence of a Fisher effect. However, the same degree of consistency is not observed in respect of other developing countries.

Despite the fact that a number of arguments have been put forward in an attempt to explain the failure of the Fisher effect, the evidence in respect of these arguments have not been consistent.

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