CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The original idea relating stock returns to the inflation are commonly attributed to Irving Fisher (1930). The hypothesis has come to be known as the "Fisher Hypothesis", which had received wide acceptance among economists. This basic theoretical concept had played an important role in monetary theory, finance and macroeconomics in the pre-war period. Belief in the Fisher Hypothesis had experienced a set back during the post-war period, where a number of major new analytical breakthroughs had found contradictory evidences.

The literature review on the relationship between stock returns and inflation since 1930 to 2001 can be simplified in Table 2.1.

Table 2.1. Literature Review on Relationship Between Stock Returns and Inflation 1930-2001.

Year	Author	Stock Returns and Inflation	Relationship
(I) Classical View on Stock Returns and Inflation – Fisher Hypothesis (1930)			
1930	Irving Fisher	nominal stock returns and inflation	positive
		real stock returns and inflation	invariant
(II) Post KeynesianView on Stock Returns and Inflation (1970-1980)			
1973	John Litner	stock returns and inflation	negative
1976	Nelson	stock returns and inflation (anticipated and unanticipated inflation)	
		(i) contemporaneous effect	negative
		(ii) lag correlation	negative
1976	Bodie	nominal stock returns and inflation (portfolio selection)	negative

Year	Author	Stock Returns and Inflation	Relationship
1976	Fama and Schwert	stock returns and expected inflation (Treasury Bill is used as proxy for inflation)	negative
(II)	**Post KeynesianView on Stock Returns and Inflation (1981-1990)**		
1983	Geske and Roll	stock returns and inflation (macroeconomic event)	negative
1983	Solnik	stock returns and expected inflation (Eurocurrency market)	negative
1983	Gultekin	stock returns and inflation	inconsistent results
1987	Kaul	nominal stock returns and inflation (equilibrium in monetary sector)	negative
1989	Asprem and Wasserfallen	stock returns and inflation	negative
(III)	**Post KeynesianView on Stock Returns and Inflation (1991-2001)**		
1991	Najand and Rahman	stock returns and inflation	negative
1993	Boudaukh, Richardson	stock returns and inflation (contemporaneous, lead and lagged inflation)	negative
1994	Boudaukh, Richardson & Whitelaw	stock returns and inflation (cross-sectional analysis)	different cyclical tendencies
1995	Erb *et al*	expected stock returns and inflation	negative
1996	Lee and Ni	nominal stock returns and inflation (temporary and persistent inflation)	negative
1999	Choudhry	nominal stock returns and inflation	negative
2000 2001	Omron and Pointon	nominal stock returns and inflation (cross sectional and co-integration analysis)	negative

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2.2 The Classical View on Stock Returns and Inflation

The classical Fisher Hypothesis (1930) stated that only nominal stock returns vary one-to-one with inflation. The real stock returns are invariant to the price level *per se*, these returns depend fundamentally upon production functions or input-output. The argument was that, in equilibrium the real stock returns must be simultaneously equal to the marginal and substitution rate of capital goods between the adjacent time periods. Irving Fisher identified this as the marginal rate of 'time preference', where neither of these depend on the price level.

Since the real stock returns is invariant to inflation, the real present value of these flows is also unaffected either by current inflation or by the expectation of future inflation. This means that only nominal value will vary in direct proportion to the general price level, making nominal capital gains on equity equal to the inflation. In short, the Fisher Hypothesis emphasized that real stock returns and inflation are independent whereas the nominal stock returns vary one-to-one with inflation.

2.3 Modern and Post-Keynesian View on Stock Returns and Inflation

Over several decades, modern Keynesian and neo-Monetarist economists have moved far beyond the classical preoccupation, from observing long-run static equilibrium to shorter term equilibrium. The modern Keynesian has abandoned the simple classical presumption that the price structure in financial market did not affect the 'real' equilibrium of the economy. The new theory concentrated on the dynamic adjustment process of

the economy, which developed into more concrete theoretical and econometric models. The modern Keynesian's model involved the interactions between price, physical volumes and returns in the 'real' sectors of economy with the returns on financial asset.

2.3.1 Literature Review on Stock Returns and Inflation during 1970-1980

Lintner's (1973) statistical analysis shown that stock returns was negatively rather than positively related to inflation as standard Classical Fisher Hypothesis presumed. The adverse effect could be further elaborated with the following assumptions. Firstly, the fixed proportionate changes in all prices (including wages, material rates, all inputs as well as output prices) upon a firm. Secondly, stock returns and real investments are proportional to physical output at all times. Thirdly, depreciation is also proportional to stock returns and is taken at replacement cost for tax purposes. Fourthly, corporate profits are taxed at a fixed percentage rate. Fifthly, prices at all times provide a fixed percentage margin of gross operating profit over inventories. With these assumptions, it is easy to show that the excess current dollars outlay for fixed investment over gross funds (retained earnings plus depreciation) is a fixed fraction of current dollar sales, say bS_t, where b is invariant to inflation.

According to Litner's study (1973) which was based on the "Source and Application of Funds" in the basic accounting, additional external funds will be required to cover the increase in cash balances and accounts receivable inventories. The theory assumed that cash balances bear a fixed ration to current dollar sales and there is no interest income on cash. Based on this basic

assumption, Litner (1973) stated that these "additional" demand for external funds (ΔF_t) is a fixed fraction of the increases in current dollar sales, say $a\Delta S_t$, where a is necessarily positive and also invariant to inflation. Consequently, the total demand for external funds could be expressed as :

$$\Delta F_t = a\Delta S_t + bS_t \qquad (2.1)$$

ΔF_t total demand for additional external funds

a fixed fraction of the increases in current dollar sales

ΔS_t increases in current dollar sales

bS_t current dollar sales

Since under Litner's assumption (1973), both retained earnings and gross funds are respectively proportional to S_t , the ratio of external and internal financing will increase with inflation rates if $\Delta F_t / S_t$ does so; but the latter is a linear increasing function of $\Delta S_t / S_t$ which is an increasing function of inflation. The relative dependence on external financing necessarily varies directly with inflation. Thus, the greater relative dependence on external financing due to the increased in inflation will reduce the stock returns.

Litner's analysis (1973) also concentrated on the adverse effect of unanticipated and transient increases in inflation. These effects would be even more significant if there is an increase in expected future inflation. Indeed, an increase in anticipated future inflation involves a much larger reduction in the current period's real returns on equity ownership. Litner's study (1973) consequently explained the negative relationship of both nominal and real stock returns with inflation, whether anticipated or unanticipated.

Nelson (1976) argued that the adjustment of the stock returns due to anticipated inflation would be easier to trace if actual changes in inflation could be decomposed into anticipated and unanticipated components. Full decomposition is feasible only when there is complete access to all information in the market. Nelson (1976) emphasized that it is necessary to isolate that portion of any change that could not be predicted (linearly) from past inflation. He carried out the latter kind of decomposition by obtaining an appropriate representation of the inflation series as discrete linear stochastic process.

The most striking features of the empirical results from Nelson's study (1976) are the uniformly negative and statistically strong correlation between stock returns and inflation. While negative correlation for contemporaneous or leading inflation could reconcile with the Fisher Hypothesis if the market reacts strongly and negatively to unanticipated increases in the inflation. However, the negative lagging correlation in Nelson's analysis (1976) are much more difficult to reconcile with the Fisher Hypothesis since past inflation contain no surprises.

Bodie (1976) offered an explanation on the effectiveness of stock returns as an inflation hedge. The analysis tried to specify to what extent stock returns can be used to reduce the risk of an investor's real return, which stemmed from uncertainty about the future level of prices of consumption goods. Bodie's study (1976) based on Markowitz-Tobin Framework, which concentrated on mean variance model of portfolio choice. In Bodie's model,

the process of portfolio selection is divided into two separate stages. The first stage is to identify the efficient portfolio frontier-the minimum variance frontier, and in the later stage is to choose the optimal portfolio on the frontier.

In the Bodie's literature (1976) on stock returns as an inflation hedge, it could be define in two distinct ways accordingly. The first alternative definition of a stock returns is an inflation hedge if it offered 'protection' against inflation, which in turn means the elimination or at least the reduction of the possibility that the real stock returns will fall below some specified 'floor' value such as zero. The second alternative definition referred to stock returns is an inflation hedge if and only if its real return is independent from inflation. This independent relationship implied that changes in inflation should be accompanied by an equal change in nominal stock returns. In short, a negative relationship between nominal stock returns and inflation and no correlation between real stock returns and inflation.

Bodie (1976) based his analysis on the annually, quarterly and monthly Consumer Price Index (CPI) and United State Treasury Bill from 1953 to 1972, found that the effectiveness of stock returns as an inflation hedge depend on two parameters. The first parameter depends on the ratio of the variance of the non-inflation stochastic component in stock returns to the variance of inflation. The larger the variance ratio is, the less effective is equity as an inflation hedge; the second parameter depends on the difference between nominal return on nominal bond and the coefficient of inflation. The

greater the absolute value of this difference, the more effective stock returns as an inflation hedge.

In Fama and Schwert's paper (1977), expected inflation was measured by the Treasury bill rate at the beginning of the period. The change in expected inflation was simply the change in the T-bill rate, and unanticipated inflation was the ex post different between the actual inflation rate and the beginning of the period T-bill rate. This is good evidence that the inflation and the monetary base growth are closely associated. In fact, it is simply based on adaptive expectations model to explain the anomaly.

$$\overline{\pi}_{t+1} = \overline{\pi}_t + \gamma(\overline{M}_{t+1} - \overline{\pi}_t) + \varepsilon_t \qquad (2.2)$$

$\overline{\pi}_{t+1}$ expected inflation at the end of period t

$\overline{M}_{t+1}$ expected money base growth rate at $t+1$

γ speed of adjustment coefficient for expected inflation

ε_t random disturbance

Fama and Schwert (1977) assumed that the reverse causality notion of unexpected stock returns signaled the expected money base growth rate can be written as a simple linear model

$$\overline{M}_{t+1} = a + b\,(R_t - \overline{R}_t) + \xi_t \qquad (2.3)$$

$\overline{M}_{t+1}$ expected money base growth rate at $t+1$

R_t nominal stock returns at period t

$\overline{R}_t$ expected nominal stock returns at period t

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Fama and Schwert (1977) confirmed that the response of coefficient b is negative and probably quite small. Thus, Fisher Hypothesis for risky assets in terms of expectations can be written as,

$$\begin{aligned} \overline{R}_t &= r_t + \overline{p}_t + \overline{\pi}_t \\ &= \overline{p}_t + RF_{t-1} \end{aligned} \tag{2.4}$$

r_t real riskless return

$\overline{p}_t$ expected risk premium

RF_{t-1} Tresury Bill at t-1

The Fisher Hypothesis for the Treasury bill rate has the same form but a zero risk premium,

$$RF_{t-1} = r_t + \overline{\pi}_t \tag{2.5}$$

Substituting equations (2.4) and (2.5) into (2.3) and (2.2)

$$RF_t - RF_{t-1} = \alpha t - b\gamma \overline{p}_t + \gamma[\, b R_t - (1+b)\, RF_{t-1}\,] + \gamma\xi_t + \varepsilon_t \tag{2.6}$$

Where $\alpha t = a\gamma + r_{t+1} - (1-\gamma)\, r_t$

If the above reverse causality argument is correct and uncertainty stock returns do signal changes in the expected money base growth rate. The simple adaptive expectation model for expected inflation is plausible by rearranging the equation so that the stock returns are the dependent variable yields,

$$R_t = \frac{-\alpha_t}{b\gamma} + \overline{p}_t + \left(1 + \frac{1}{b}\right) RF_{t-1} + \frac{1}{b\gamma}\,[RF_t - RF_{t-1}] - \frac{\gamma\xi + \varepsilon_t}{b\gamma}$$

$$= \beta_{0t} + \beta_1 RF_{t-1} + \beta_2 [RF_t - RF_{t-1}] + \mu_t \qquad (2.7)$$

where $\mu_t = -(\gamma\xi_t + \varepsilon_t)/b\gamma$

Both the level and change effects of Fama/Schwert Equation (2.7) are direct algebraic results of reversing the "causality" between stock returns and inflation. When the simple adaptive expectations model for expected inflation, Equation (2.6) is reversed, the Fama/Schwert 's result of negative relationship between stock returns and inflation is induced from the Equation (2.7).

2.3.2 Literature Review on Stock Returns and Inflation during 1981-1990

Geske and Roll (1983) argued that stock returns signal changes in the inflationary process could be justified through the chain of macroeconomic events. The chain could be simplified in three levels beginning from the government revenue, expenditures to Treasury bill.

According to Geske and Roll (1983), the first chain started with the government revenue. The government principal revenues are from personal and corporate taxes. When stock prices increase or decrease in response to anticipated changes in economic conditions, personal and corporate incomes move in the same direction, inducing a similar change in government revenue. Thus, fluctuations in government revenue are closely related to stock returns.

The second chain would be the government expenditures. Geske and Roll (1983) further elaborated that if government expenditures do not

accommodate themselves to changes in revenue, fluctuations in revenue will be reflected in deficits. Empirical results shown that the government deficit has paralleled a rapid rise in the fixed portion of government expenditures or "entitlements". These entitlements or so called "uncontrollable expenses", have grown to be about eighty percent of the Federal government budget. To the extent that such expenditures really are fixed, changes in economic conditions should be followed by opposite changes in the deficit.

Geske and Roll (1983) reported that when a deficit occurs, the Treasury is obliged to borrow. It could repay the debt during later surplus periods provided that the direct tax revenues increased or expenditures decreased enough to generate such a surplus. Instead, the typical *modus operandi* in recent years has been to have the Federal Reserve System "monetize" the debt by printing currency or expanding bank reserves. This effectively generates the required surplus by indirect taxation through the inflation caused by an increased rate of monetary growth.

Geske and Roll's study (1983) recapitulated that a change in stock returns predicted a change in government revenues. Given largely fixed government expenditures, fluctuating revenues lead to periodic government deficits and concomitant increases in government debt. The larger debt caused an increase in expected future indirect tax liabilities, both personal and corporate, subsequently to the debt monetization and inflation. The scenario could be worse when stock returns decline, the government will tend to run a deficit; then given the practice of monetization (which will be anticipated by

rational citizens), expected inflation will rise. Thus, stock returns changed, which are caused by changes in anticipated economic conditions, will be negatively correlated with changes in expected inflation.

Geske and Roll (1983) incorporated the money demand explanation into their analysis by considering an economy with a perpetually balanced budget. In such an economy, some inflation would occur if stock returns fell even though there was no deficit. A decline in real activity will reduce the demand for money, and if the supply of money remains unchanged, inflation must rise.

In short, Geske and Roll's argument (1983) could be simplified as follows: a random negative shock affected stock returns which, in turn signaled higher unemployment and lower corporate earnings. This lead to lower government revenues as in personal and corporate taxes. If the government expenditures did not change to accommodate the change in revenues, the Treasury's deficit will increase. Under these circumstances the Treasury responded by increasing borrowing from public. The Federal Reserve System will purchase some of the change in Treasury debt and eventually pays for it by expanding the growth rate of base money. Higher inflation is induced by the altered money base growth rate. Rational investors realized that a random real shock signaled by the stock market would trigger this chain of fiscal and monetary responses. Thus, they alter the prices of short-term securities contemporaneously with the stock return signal.

Solnik (1983) provided empirical evidence on the relation between stock returns and expected inflation for nine countries (the Eurocurrency market) over the period of 1971-1980. The Eurocurrency market was selected in his study due to the reason it is a free market for short-term interest rate, as compared with most of the countries, the rates are set or at least heavily controlled by government. When no domestic equivalent exists, the Eurocurrency is undoubtedly the best measure of a true market rate. Even for US, the Eurodollar rate might be a better measure of expected inflation than the T-bill rate since the Federal Reserve had a policy of T-bill rate manipulation before October 1979. By using interest rate as a proxy for expected inflation, the empirical results provided support for the negative relationship between stock returns and expected inflation, just as Fama and Schwert's research (1977).

Similar time series regressions were tested by Gultekin (1983) in twenty-six countries for the period of January 1947 to December 1979, where stock returns were obtained from two reliable resources. First, The International Financial Statistics (IFS) which included 60% of the market value of all shares traded in the most active stock exchange in each country and are averages of daily or weekly closing prices for most countries. Second, the Capital International Perspective (CIP), a Swiss-based investment services firm provides stock market indices based on 1100 share prices listed on the stock exchanges of 18 countries. Unfortunately, the empirical results did not support either Fisher Hypothesis (1930) or Fama's analysis (1976), where the

stock returns-inflation relationship is not stable over time among countries.

Kaul (1987) argued that the relationship between stock returns and inflation are caused by the equilibrium process in the monetary sector. More precisely, these relationship varied over time in a systematic manner depending on the influence of money demand and supply factors. In other words, it could be negative, positive or insignificant. In order to test the robustness of the hypothesis, Kaul separated the analysis into two section which is, pre World War II (1930's) and post World War II period by using evidence from four well developed markets, i.e. United State, United Kingdom, Canada and Germany.

Kaul analysis (1987) found that before Wold War II, Federal Reserve failed to prevent bank failures and the decline in money growth. The analysis lead us to believe that the 1930's were a period during which the Federal Reserve seemed to follow, or at least allow a pro-cyclical monetary response. This conjecture seems to be borne by the facts that between 1929-1933, Gross National Product (GNP) fell by thirty percent and unemployment rose from three to twenty five percent, while both money supply and prices fell by about twenty five percent. After 1933, real GNP, money supply and prices tended to rise together. The pro-cyclical monetary policy in turns lead to insignificant or positive relationship between stock returns and inflation.

Further analysis into the post-war period, Kaul (1987) provided evidence that the countries experienced negative stock returns and inflation

relationship. This can be explained by a combination of money demand and counter-cyclical money supply effects. The economic rationale for such negative relationship is based on a reverse causality effect as discussed by Geske and Roll (1983).

Asprem and Wasserfallen (1989) explored the relationship between macroeconomic variables, stock prices and asset portfolios in European countries. Just as the Fama and Schwert's (1976) and Geske's studies (1983), negative relationship were found. Also, Najand and Rahman (1991) argued that the volatility of inflation increases the volatility of stocks, thus in turn causing a higher required stock returns, which mean a fall in stock returns.

2.3.3 Literature Review on Stock Returns and Inflation during 1991-2000

Boudoukh and Richardson (1993) examined the relationship between stock returns and inflation in short and long term. Their study is based on short and long-term interest rate with inflation for period of 1802-1990, covering both United States and United Kingdom market. The empirical results focused on contemporaneous inflation and the stock returns, the study regressed one year stock returns on one year inflation; five years stock returns and five years inflation. The results revealed that a negative relationship between stock returns and inflation in short term, but in long term horizon, this relationship tended to be positive.

Boudoukh, Richardson and Whitelaw (1994) extended the existing literature between stock returns and inflation into cross-sectional industries. Based on monthly data for the period of 1953-1990, Boudoukh, Richardson and Whitelaw (1994) sorted the firms into twenty-two industry sectors. The focus of the study is to use an asset-pricing model to predict cross-sectional variation in the coefficients of expected inflation across various industry portfolios. An unique feature of the model is that it synthesized some of the more palatable features of existing explanations of the negative relationship, such as to develop the model in a money-neutral world, so that the basic premise underlying Fisher's Hypothesis is maintained. Boudoukh, Richardson and Whitelaw (1994) evidenced a co-movement between stock returns and inflation of different industries, where different industries possessed different cyclical tendencies with the overall economy.

Erb *et al* (1995) examined the interaction between the inflation and both time series and cross sectional expected stock returns in forty-one developed and emerging equity markets. The results of the study confirmed the negative time series relationship between inflation and stock returns when focused on country-by-country basis. Also, the study found that negative relationship is maintained when longer horizon of stock returns are examined, otherwise, when this study investigated the relationship in long-term inflation and long term stock returns, it did not find a positive relationship between both variables. Hence, the study suggested that international equity returns only serve as an hedge against inflation in short horizon rather than long horizons.

Unlike those studies that used either the level of expected or unexpected inflation, Lee and Ni (1996) examined the effects of temporary and persistent components of inflation. However, to a certain degree, expected and unexpected may be related to persistent and temporary components. Expected inflation is mainly composed of persistent movements, and by definition, unexpected inflation is white noise process. Since a white noise process has a rectangular spectral density, it contains the entire spectrum of frequency movement of equal strength.

In Lee and Ni's study (1996), there are two aspects that made the temporary-persistent decomposition reconciling the puzzle finding in Fama and Schwert's work (1977). Firstly, the decomposition substantially reduces the sensitivity of the results to the particular forecasting models chosen. Secondly, the source of the correlation between inflation and stock returns is different over the frequency spectrum, which the temporary-persistent decomposition can identify. The temporary and persistent components are obtained by second-order Cherbyshev filters.

Lee and Ni (1996) reported that although use of this application of filter in economics and finance has been rare, it has several advantages over methods based on stationary and non-stationary dichotomy. A commonly used time-domain method of decomposition is to treat the non-stationary component as persistent and the stationary as temporary. Chebyshev filters can decompose a stationary series into two components, a high frequency band (temporary) and a low frequency band (permanent). The cutoff frequency

determined the variability of the temporary component and the smoothness of the persistent component.

The main findings of Lee and Ni (1996) once again proven that both temporary and persistent components of inflation have negative correlation with stock returns, but with different patterns. The evidences are consistent with the theory that a rise in persistent inflation predicted slower future real activities, and a consequent decreased in stock returns. A rise in temporary inflation induced investors to shift their portfolios from stocks to interest bearing liquid assets because a rise in the temporary inflation decreases the relative attractiveness of stock returns, even though market's present value of future cash flow is unchanged.

Choudhry (1999) investigated the relationship between stock returns and inflation based on Fisher Hypothesis for four high inflation countries in Latin and Central American during 1980-1990. The countries are Argentina, Chile, Mexico and Venezuela. The stated relationship is tested by means of linear regressions once it is confirmed that all series are stationary.

Choudhry's analysis (1999) showed that a direct one-to-one relationship between the current nominal stock returns and inflation for Argentina and Chile. This result indicated that stock returns act as a hedge against inflation. Further tests are conducted to check for the effects of the leads and lags of inflation. Evidence of a direct relationship between current nominal returns and one-period inflation is found. Results also showed that

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significant influence on nominal returns is imposed by lag but not by leads of inflation. The result is against the claim that the past inflation may contain important information regarding future inflation rate. In short, the study evidenced a positive relationship between nominal stock returns and inflation is possible during short horizon.

Choudhry (1999) further investigated the relationship between real stock returns and inflation. In contrast with Fisher Hypothesis (1930), a significant negative effect of current inflation and one period lagged inflation on real stock returns is found. Similar to the nominal stock returns, leads of inflation impose very little effect and lags impose substantial effect on real stock returns. Given the contrasting results, the relationship between stock returns and inflation once again puzzling the effect of risky asset under Fisher Hypothesis (1930).

Omron and Pointon (2000) examined the cost of capital in Egypt based on a sample of one hundred and nine companies. According to Omron and Pointon (2000), when Egypt started its economic reform program by late 1990, the inflation had been targeted to be under control in order to create an attractive environment for investment. With regard to this program, Egypt had witnessed major and radical changes in economic climate. Although Omron and Pointon's investigation (2000) was a cross-sectional study rather than a time series analysis, they observed that based upon an international comparison of forty-one countries, Egypt has a very high cost of equity exceeded only by Peru, Pakistan and Columbia. Since Egypt is a fairly new

emerging market, so it is logical to encounter a high perceived risk, even the Treasury bill rate was high, approximately nine percent in 1998. Clearly, this experience of high cost of capital suggested that inflationary effects had impact on the performance of the individual firms.

Omron and Pointon (2001) extended their study to focus on effects of the inflation on stock returns, in term of market activity and market liquidity. From the co-integration analysis through Error Correction Mechanisms (ECM), significant long-run and short-run relationships between the variables are found. The results revealed that inflation decreased sharply after the introduction of the economic reform program due to the tight fiscal and monetary policy. The decrease in the inflation give a good sign to investors to invest in the stock market, as it means that there will be an expansion in business sector. In turn, the returns of companies will increase, meanwhile expected interest rates will decrease, and this will encourage investors to establish new firms. In short, all stock market variables benefited significantly from the changes in the inflation.