The Investment Analysts Journal

Die Beleggings-Navorsers Tydskrif

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Inhoud

This issue in brief

Inflation and unemployment: The root causes of the capitalist dilemma

There was a time during the immediate post-war period when any rise in domestic inflation (above say the 2-3 per cent level), could be countered successfully by restrictive monetary and/or fiscal policies. That time, however, sadly has passed, and we find ourselves today in a new situation in most Western industrialised countries in which both inflation and unemployment move up together. Previously, an increase in unemployment, brought about by policies of deflation, had a fairly immediate and favourable effect on the level of inflation. Now rising inflation threatens to drag unemployment up even higher with still greater unemployment the only way seemingly to some relief from the price spiral process. Why have we got into this situation and is it something that can be corrected without a radical transformation of capitalism as we know it? This is the question to which Mr Jammine addresses himself from the vantage point of London although he does attach some concluding thoughts about inflation in South Africa.

The random walk model and the behaviour of gold prices: A note

The rise in the gold price to $850 an ounce in January 1980 and its subsequent "correction" to levels more understated but still by historical standards high, have kept the metal at the centre of investment attention both in South Africa and abroad. While much has been said about the unpredictability of the gold price, the numbers of those who claim some special knowledge as to where it is going still abound, and there are few concerned with financial markets who do not have a 'gut' feel as to what the investment response should be to changes in it as and when these occur. The question arises, however, as to whether the free market for gold is not an efficient market in the sense so often applied to discussions of the behaviour of stock exchanges. The paper by Mr J. P. Botha sets out to test empirically whether or not the gold price follows a random walk and comes to a conclusion that investment analysts, dedicated to objective investigation, should not ignore.

An analysis of the behaviour of market prices during rights issues
The trouble with rights issues is that they tamper with per share data and, thus, affect their historical consistency. This is not always realised by the lay investor and may even be ignored by the professional investor when undertaking an evaluation. It is, therefore, important to study the behaviour of share prices during the period of rights issues for it is only through such study that meaningful conclusions about the efficiency or otherwise of stock markets can be reached.
This paper by Messrs I. J. Lambrechts and F. J. Mostert fills an important gap in our local research even if it comes to conclusions that are a little discouraging.

An empirical comparison of the performance of different stock market indices
This is another useful technical paper by three authors familiar to readers of The Investment Analysts Journal. It examines the performance of the JSE in terms of five different stock market indices and comes up with some interesting results. The paper comes to the surprising conclusion that the method of computation of an index can be a more important source of variation in it than is the actual sample of securities chosen as constituents.

Interest rates, yield curves and the valuation of ordinary shares
When the prospects for the growth of earnings per share improve, investors are often tempted to ignore the very important role played by interest rates and interest rate changes in the equity valuation process. This brief article in our Investment Basics series serves as a warning against doing this. This article examines the fundamental connection between interest rates and estimated present values, and also the importance of distinguishing between short-term and long-term interest rates in determining appropriate rates of discount.

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The Investment Analysts Journal

Die Beleggings-navorsers Tydskrif

In the Investment Basics section of this issue of the Investment Analysis Journal, we carry an article which discusses the connection between interest rates and ordinary share valuation. It is appropriate that we do so, for the conclusion might have been reached by some in South Africa that the connection had become irrelevant given the recent behaviour of share prices on the local stock exchange. Of course, factors other than interest rates have always to be taken into account when evaluating equities and these factors can exercise a very powerful influence on share prices, but, at the end of the day, the opportunity costs of equity investment cannot be ignored. Disregarding such cost leads to errors and, ultimately, to market correction and disappointment.

The investment situation in South Africa at the present time is unusual on two important respects. First, the increase that has taken place in the price of gold has been so large compared with a year ago, as to totally transform the underlying economic situation. Through skilful management, the authorities have drained much of the resultant liquidity out of the system, but whereas a year ago the balance of payments still exercised a measure of restraint on government growth policies, this is no longer the case. On the contrary, the authorities have now resorted to various means to prevent the balance of payments exercising too encouraging an influence on portfolio investment sentiment.

Second, interest rates in South Africa, largely because of what has been happening to the balance of payments, have fallen excessively, both compared with overseas interest rates and compared with domestic rates of inflation. As long as this persists it must be favourable to industrial companies and it should, therefore, not be surprising that corporate profits are now increasing aggressively. But there is something inherently unstable about what is presently happening. It cannot carry on without ultimately running the risk of worsening inflation, and all that that implies for the purchasing power of currency in a country where large numbers of people continue to live close to, if not below, subsistence levels or continue to depend for their sustenance on relatively fixed incomes.

The trouble is that interest rates are not really being allowed to do their job properly. They really are low in South Africa because exchange control continues to protect local money and capital markets from quantitatively serious fund withdrawals. Would the commercial rand be trading at a premium to the dollar in a world in which exchange control did not exist? The current discount to the dollar of the financial rand must provide the answer to that question. And if local long-term gilt rates are clearly below the running and

In die afdeling in hierdie uitgawe van Die Beleggings-navorsers Tydskrif wat handel oor beleggingsgrond-beginsels bied ons 'n artikel waarin die verband tussen rentekoerse en die waardering van gewone aandele bespreek word. Dis 'n baie paslike bespreking, want sommige Suid-Afrikaners het dalk tot die slotsom gekom dat die verband nie meer van toepassing is nie, as die gedrag van aandeelpryse op die binnelandse effektebeurs in ag geneem word. Ander faktore as rentekoerse moet natuurlik altyd by die evaluering van gewone aandele in rekening gebring word en dié faktore kan 'n baie sterk invloed op aandeelpryse uitoefen, maar op die ou end kan die alternatiewe koste van gewone aandelebelegging nie veronagsaam word nie. As dié koste nie in ag geneem word nie, lei dit tot foute en, uiteindelik, tot markkorreksie en teleurstelling.

Die beleggingsituasie in Suid-Afrika is tans in twee belangrike opsigte ongewoon. In die eerste plek was die styging in die goudprys so groot in vergelyking met 'n jaar gelede dat dit die onderliggende ekonomiese situasie geheel en al laat verander het. Deur middel van deskundige bestuur het die owerheid heelwat van die gevolglike likwiditeit uit die stelsel verwyder, maar waar die betalingsbalans 'n jaar gelede nog 'n mate van beperking op regeringsgroeibeleidspunte uitgeoefen het, is dit nie meer die geval nie. Inteendeel, die owerheid het hom nou tot verskeie maniere gewend om te verhoed dat die betalingsbalans 'n te bemoedigende invloed op portefeuljebeleggingsentiment uitoefen.

In die tweede plek het rentekoerse in Suid-Afrika, grootliks as gevolg van wat met die betalingsbalans aan die gebeur was, buitensporig gedaal, vergeleke met oorsese rentekoerse sowel as die binnelandse inflasiekoers. So lank as wat dit voortduur, moet dit gunstig wees vir nywerheidsmaatskappye en dit behoort dus nie verbasend te wees dat maatskappywinste nou teen 'n aggressiewe tempo toeneem nie. Maar daar is iets inherent onstabiels omtrent die huidige verwikkelinge. Dit kan nie so voortgaan sonder om uiteindelik die risiko te loop van inflasie wat al hoe erger word en alles wat dit inhou vir die koopkrag van valuta in 'n land waar groot getalle mense steeds naby of selfs onder bestaanspeile leef of steeds op betreklik vaste inkomstes vir hulle lewensonderhoud staat maak nie.

Die probleem is dat rentekoerse nie in werklikheid toegelaat word om hulle werk behoorlik te verrig nie. Hulle is werklik laag in Suid-Afrika omdat deviesebeheer steeds binnelandse geld- en kapitaalmarkte teen fondsonttrekkings van ernstige hoeveelhede beskerm. Sou die kommersiële rand teen in premier teenoor die dollar verhandel word in 'n wêreld waar deviesebeheer nie bestaan nie? Die huidige diskonto van die finansiële

prospective rate of inflation, which many would argue is the case, can it be expected that this will continue to be the case indefinitely? What investor worth his salt knowingly opts for a return which he calculates must ultimately be negative in real terms? We are forced to the conclusion that institutions and individuals who buy government stock on current yields do so either because they have to, or because they believe that they have superior insights and/or analytical prowess and, thus, will be able to get out before the inevitable crash comes.

Either way, the situation is not a healthy one and this is something equity investors must take into account in their decision making.

The Editor

rand teenoor die dollar moet die antwoord op dié vraag verstrek. En as binnelandse langtermyn- prima koerse duidelik laer is as die lopende en toekomstige inflasiekoers, soos baie mense sal beweer, kan daar verwag word dat dit vir 'n onbepaalde tyd die geval sal wees? Watter belegger wat enigsins bedrewe is, sal willens en wetens 'n opbrengs kies wat volgens sy berekenings uiteindelik negatief moet wees in reële terme? Ons word tot die gevolgtrekking gedwing dat instellings en individue wat staatseffekte op huidige opbrengste koop, doen dit òf omdat hulle moet òf omdat hulle meen dat hulle oor besondere insigte en/of ontledingsvaardigheid beskik en dus die onvermydelike ineenstorting betryds sal kan vryspring.

Hoe dit ook al sy, dit is nie 'n gesonde situasie nie en dit is iets wat ekwiteitsbeleggers in ag moet neem wanneer hulle beslissings neem.

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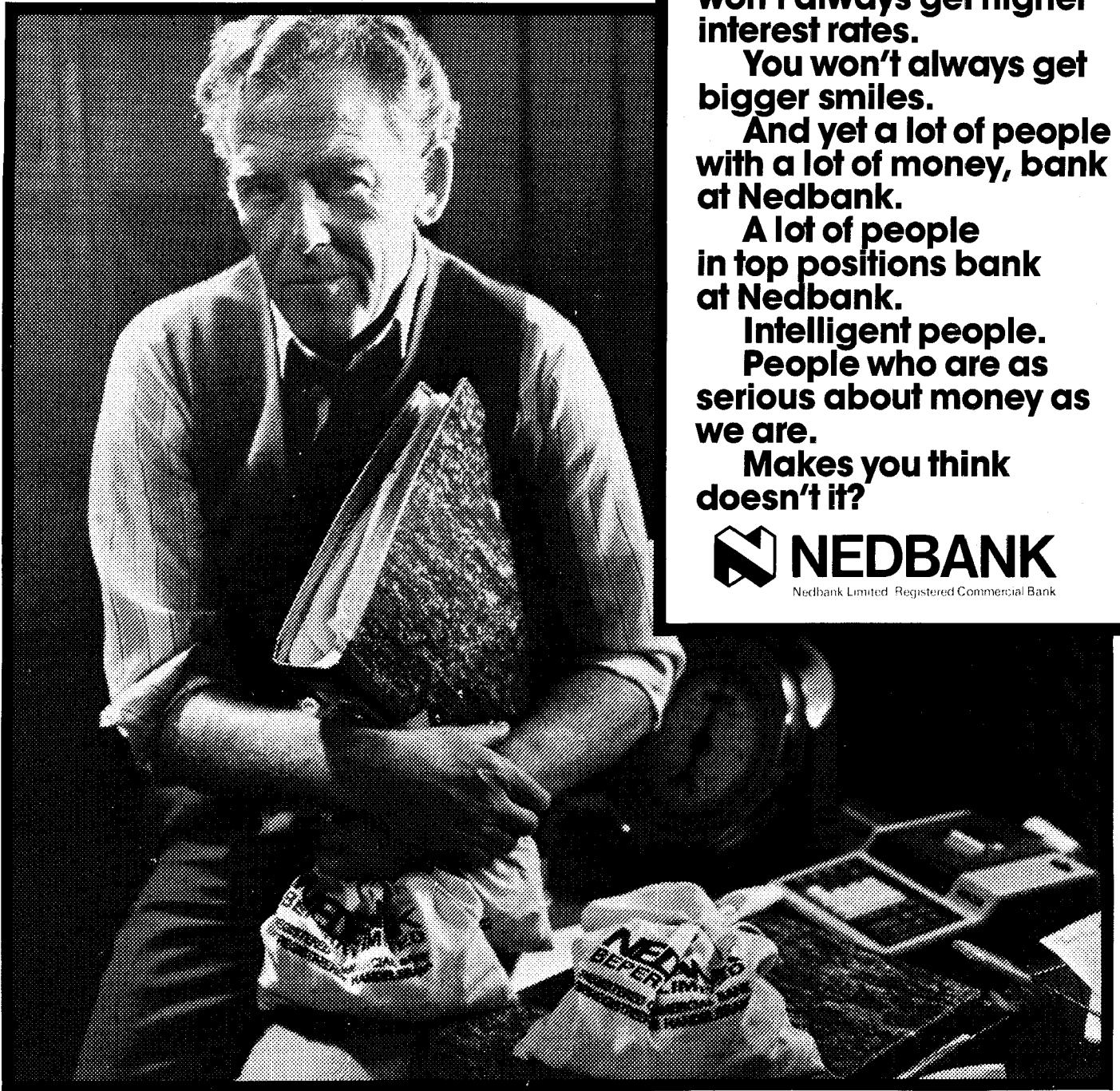Barclays Branch Manager
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By Azar P. H. Jammine

Inflation and unemployment: the root causes of the capitalist dilemma

I – INTRODUCTION

Over the past two decades the Western world has experienced successive cycles of inflation and unemployment characterised by the fact that although the two factors have risen and fallen within each cycle in opposite directions from one another, the absolute level of both has been rising over the long term. In the face of this, governments of the West have found themselves in a dilemma. They appear powerless to combat the long-term pattern of rising inflation and unemployment by means of traditional deflationary and reflationary measures and are in fact resorting increasingly in some areas to socialist policies to do so. The problem poses a threat to the whole fabric of capitalistic society.

The object of this paper is to provide some insight into the basic causes underlying the pattern of rising long-term inflation and unemployment. Definite misconceptions would appear to prevail regarding the root causes. Economists and the mass media alike have tended to put the blame on such factors as rising fuel prices, high levels of government expenditure and excessive credit creation. Such factors are indeed causes of inflation, but we hope to show that the problem would not be unbeatable were it not for the interaction through expectations between these factors and intractable deeprooted institutional causes which can be attributed to the growth of labour power on the one hand and the growth of giant corporations on the other hand during the course of this century.

II – THE TRADITIONAL NOTIONS OF INFLATION AND UNEMPLOYMENT

The key to appreciation of the problem of the permanent inflation and unemployment of our time lies in understanding how the classical price mechanism has come to be disrupted in recent times.

Looking back into the economic history of the Western world reveals that before 1957 situations of inflation accompanied by unemployment never existed in general. The two factors were mutually exclusive. To see why this was so one need only consider the classical economic laws of supply and demand as determinants of the price mechanism.

In a classical price system, the price of a good is determined by the equilibrium point of intersection between its supply and demand curves. The price level of the economy as a whole is similarly determined by the equilibrium between aggregate demand and supply curves. These curves themselves are derived from aggregation of the countless individual demand and supply curves in the economy.

Inflation, a sustained period of rising prices, occurs when demand exceeds supply. Prices increase to the point at which demand falls sufficiently and/or supply rises sufficiently to bring demand and supply back into equilibrium. Along the same line of argument, if demand exceeds supply, prices can be prevented from rising either by reducing demand or increasing supply (including productivity) so as to bring the two back into equilibrium. This is the logic behind traditional anti-inflationary policy.

Unemployment, on the other hand, implies a situation in which supply exceeds demand. Some unemployed production capacity, including labour, cannot be taken up completely by demand.

Since the traditional kind of inflation is caused by demand exceeding supply, and since the inverse is true of unemployment, it can be seen that the traditional concepts of inflation and unemployment are mutually exclusive in a price system that functions correctly. Policy to counter either of the two factors is readily at hand by appropriately monitoring supply and demand.

This is in fact what used to happen before the 1960s. During the Great Depression of the 1930s, supply exceeded demand for most products and so unemployed resources and falling prices or deflation were the order of the day. Keynes recommended as a solution that governments should spend money so as to increase demand to bring it back into line with supply, in this way largely eliminating unemployment. During the Second World War and the Korean War, the world experienced bouts of inflation caused by the tremendous strain on existing resources, i.e. demand exceeded supply; and there was little unemployment during this period. The inflation was cured when governments acted to reduce demand during the subsequent post-war periods and returning servicemen boosted the labour force and increased supply. Demand and supply were thereby brought back into equilibrium and prices no longer rose.

III – THE NEW INFLATION

Prior to the late 1950s, situations of inflation were temporary phenomena which seldom coincided with unemployment, and inevitably came to an end. But since the late 1950s (and long before the world energy crisis) the world has been experiencing ever-growing continuous cycles of inflation coupled with unemployment. The answer as to what has taken place to create the new situation lies in the evolution of certain institutional and structural factors which have prevented prices from falling when they have needed to fall to restore equilibrium between supply and demand. As a consequence the price mechanism has been imbued with an upward inflationary bias. Since price levels have been held up at artifical above-equilibrium levels, demand has been unable to increase naturally in traditional fashion and consequently has lagged behind supply. Unemployment of both production capacity and labour has ensued. Over time the disequilibrium between potential demand and supply has been growing ever bigger, unemployment has been increasing and so too has the upward bias in prices.

To see how institutional and structural factors have disrupted the price system it is first necessary to examine the price-setting mechanism. Until the early part of the

current century, most firms were rather small compared with the total market. Prices were determined neither by producer nor by consumer but rather by wholesale merchants whose economic function it was to equate a demand and a supply the sources of which were equally beyond their control[15]. Since the aim of these wholesale merchants was to maximize their turnover, this was best accomplished by fixing a price as close to equilibrium between supply and demand as possible. Prices were thus flexible in both directions. Producers and consumers alike had no choice but to accept such prices. The separation of the function of price-setter from that of producer was thus the basis of price flexibility.

However, during the course of this century, the role of the wholesale merchant as price-setter has diminished as a result of increased integration of corporate activities and industrial concentration in the hands of fewer and larger firms. In the labour market this tendency has been reflected by increased power of trade unions. The producer in a market has tended towards becoming his own price-taker, but the consumer has nevertheless remained price-taker, accepting whatever price is set by the producer.

When for some economic reason the price of a product assumes a level above equilibrium, the producer, having assumed the role of price-setter, reduces his output rather than his price. The equilibrating mechanism of the classical price system is thus disrupted, the market becomes one of disequilibrium, is not cleared and resources are no longer fully employed. Most importantly for purposes of this analysis, prices tend to become inflexible downwards. The moment that prices become more rigid in a downward direction than in an upward one, an upward price bias necessarily exists and an inflationary force becomes inherent in the price system. Relating the micro-economic picture to the economy as a whole, if the price of one good is kept artificially high when it ought to fall, relativity with other prices can only be maintained through a rise in all other prices, in other words through a rise in the general price level.

Initially, the effect of downward price rigidity in one market on the whole price structure may be negligible. But taken over several decades and over hundreds of markets, the upward bias builds up cumulatively and is no longer a negligible magnitude.

IV – THE INSTITUTIONAL FACTORS MAKING FOR THE NEW INFLATION

The most important market in which the disequilibrium just described has manifested itself has been the labour market. The price of labour is the wage rate. At the beginning of this century and in previous centuries, when the supply of labour exceeded demand (i.e. a situation of unemployment), wages declined to levels where industry increased its demand for labour and in so doing took in unemployed workers. However, this century has witnessed improved social well-being, greater interest in the welfare of the wage-earner, improved unemployment benefits and a rise in the power of the trade unions. Spillover wage increases, where wage-earners demand and obtain a rise purely on the grounds that their opposite numbers in another firm or industry have obtained such a rise, have become commonplace. The outcome has been the virtual disappearance of any semblance of wage reduction, even in conditions of large-scale unemployment. On the other hand, when industry has demanded more labour than that available, the price of labour (i.e.

wages) has nevertheless risen, as wages should do. The result is that on the world labour market wages have become inflexible downwards, but flexible upwards, in this way instilling an upward bias into the wage structure.*

Downward rigidity of wages is by no means confined only to unionised workers, but is in fact the order of the day for the vast majority of wage-earners in all walks of life. Nor is it a totally recent phenomenon either. One of the very reasons for the revolution in economic theory wrought by Keynes was that his "General Theory"** was based on wage rigidity which reflected a certain amount of stickiness in wages as far back as the thirties. The important point to be made, however, is that the cumulative effect of downward wage rigidity over several decades has only manifested its influence significantly on the price level over the past quarter of a century.

Due to the significant portion of total costs of a corporation constituted by wages, disequilibrium in the labour market alone would be sufficient to upset the classical price mechanism over time. Indeed many theorists argue that downward price rigidity of any sort stems exclusively from downward wage rigidity[21]. However, there would appear to be a strong argument that an additional and independent structural source of disequilibrium in markets other than labour has developed as a result of the advent of the giant corporation.

At the turn of the century Western economies consisted primarily of a multitude of smallish firms each competing with the other to obtain a small share of the market. When demand for their products declined, they were forced into reducing prices competitively to the point where demand would rise sufficiently to take up all the goods they were able to produce. The prime objective of the firm was to maximise its profitability. However, in recent decades, the motivation for the operation of a firm has tended to change from one of profit maximisation to one of growth maximisation[17]. There has evolved a change in the structure of business via increased merger activity from the era of the small entrepreneur to the age of the giant corporation.

Several reasons can be cited for this, including the evolution of separation of ownership from control of companies, the lust for power, the need to satisfy the various needs and morale of company personnel through growth maximisation, as well as the growth in consumerism and increased sophistication of financial markets. The reasons are abundant and complex and beyond the scope of this study.

The relevant point is that these giant corporations which now control most of the assets of Western economies, are so powerful financially, that when demand for one of their products declines, they simply reduce production without reducing price. The result is unemployed production capacity and reduced demand for labour. On

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* All references made to downward rigidity of wages refer to real wages. In situations of zero inflation, real wages are of course equal to money wages. At the initial stages of inflation, therefore, downward inflexibility of wages refers to money wages, but once inflation gets under way, it refers to real wages., In an inflationary situation, even though money wages may be rising, inflation and unemployment may be falling if the rise in price is outpacing the rise in money wages.

** J. M. Keynes, "The General Theory of Unemployment, Interest and Money", Macmillan, London (1936).

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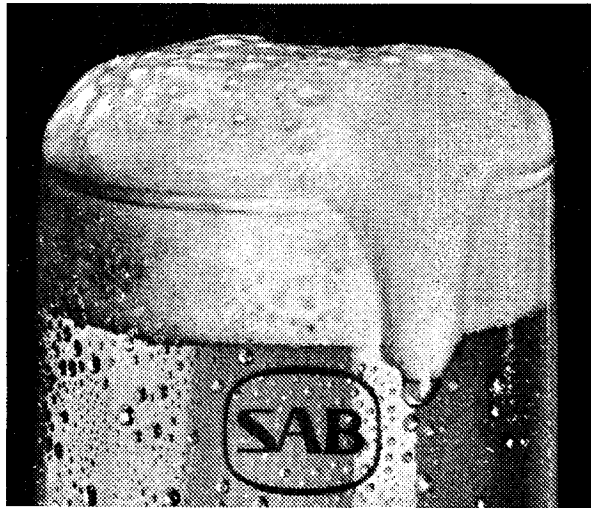
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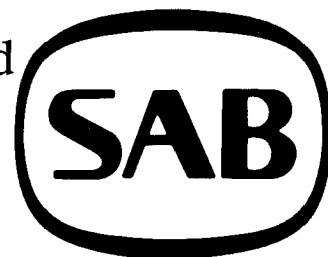
the other hand, whenever demand for their product exceeds their production capacity, they do indeed increase their prices. So here again we have upward bias in the price system. A similar argument can be made out for the growth of large agricultural and raw material co-operatives, and also cartels which administer the prices of their products.

V – THE CRUCIAL ROLE OF EXPECTATIONS

The upward bias in wages and prices would not have such a detrimental effect on the rate of inflation were it not for the crucial role which expectations play.

Firstly, there are what can be termed *defensive* wage and price increases in which expectations help in perpetuating the inflationary process once it is under way. Labour wants to recoup the expected erosion of real wages through wage increases equivalent to the expected rate of inflation and corporations try to recoup the expected erosion of their real profits by raising prices at a rate equal to the expected rate of inflation.

Secondly, there is the general case of what can be termed *aggressive* wage and price increases brought about in an attempt to increase real wages and profits for their own sake. These are usually motivated by ideology aimed at altering the distribution of income, by greed, by spillover pressures between groups of workers or companies and by a peculiar sense of pride in forcing a rise in real wages. Expectations are relevent here in the sense that they represent a yardstick by which the extent of the required aggressive real wage or price increases can be gauged. Increases of this kind are not always easily effected because of social barriers and resistance to such "aggression" at times.

Thirdly, and most importantly from the point of view of the effect of expectations on the rate of inflation and considered to lie at the very heart of the inflationary problem, are what we term *defensive aggressive* wage and price increases. There is a hedging element in expectational wage demands and price increases. Labour demands a wage increase slightly higher than the expected rate of inflation just in case inflation turns out to be actually higher than anticipated. Similarly for price increases by corporations. In so doing the rate of inflation does in fact turn out to be higher than the rate anticipated previously.*

In recent decades, by means of their crucial role in combining with labour and corporate power to induce aggressive and, more importantly, defensive aggressive wage and price increases, expectations are no longer neutral in the inflationary process. No longer do they only result in the continuity of inflation. They positively promote its acceleration.

VI – INTERACTION OF TRADITIONAL INFLATION WITH THE NEW INFLATION

There can be little doubt that there still exist several sources of the traditional kind of inflation in which demand exceeds supply capacity and that these factors

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* The terms "defensive" and "aggressive" are due to Machlup, but the term "defensive aggressive" is the author's own innovation aimed at identifying a particular class of wage and price increases which is felt to lie at the heart of the problem of the world's permanent inflation. Machlup classifies an additional category of increases which he calls "responsive". These are wage and price increases arising out of the pure price-theoretical response to a situation in which demand exceeds supply. Expectations have no role to play directly in such increases.

continue to exercise a highly significant influence on the absolute rate of inflation. One need only consider the major impact on the rate of inflation which the seemingly real shortage in fuel supplies has had in recent years. (Yet even here one could argue that the increase in consumer fuel prices to a debatable extent can be attributed to artificial shortages induced by the institutionalisation of oil resources in the form of a cartel or alternatively is the result of aggressive price increases effected by the giant oil multinational corporations.)

Important factors which are still contributing to inflation by way of inducing excess demand over supply are:

(i) The tendency of Western governments to buoy up the economic growth of their economies through excessive public expenditure programmes. These are designed partly to reduce the institutionally induced high level of unemployment or alternatively reflect a continuation of the post-Keynesian growth cult era. They are often financed through budget deficits and growth in the money supply at a rate which exceeds the prevailing growth rate in nominal GNP.

(ii) The rapid rise in international liquidity during the past decade. This has resulted from the cumulative effects of years of excessive domestic money creation described above, particularly in the United States, and the consequent astronomical growth in the development of Euro-currency and Asian-currency markets with their inherent double credit-creation capability.

(iii) The increasing scarcity of the world's natural resources, including oil and food, in the face of rapid technological advances and the population explosion.

Traditional fiscal and monetary restraint is aimed at eliminating these causes of inflation by reducing demand so as to bring it back into equilibrium with supply. In earlier years it used to prove possible for such anti-inflationary measures to succeed effectively in reducing price increases to zero. But a concerted effort along traditional lines to eliminate these causes of inflation is no longer effective because of the way in which such causes interact via expectations with the more fundamental institutional causes of inflation described earlier, against which traditional austerity measures are ineffective.

The type of interaction between the traditional and the new inflationary process can best be portrayed by an example. Suppose inflation has persisted for some time because public authorities have been embarking on some large politically essential infrastructural capital expenditure projects which have placed a strain on raw material and industrial resources. Aggregate demand exceeds aggregate supply. The government is not deterred by inflation from executing the capital projects because it feels that by appropriately reducing public expenditure after completion of the projects, the strain on aggregate supply will subsequently diminish and inflation will recede. However, unless the labour and corporate community can be persuaded of the temporary nature of the inflation, their expectations will be such as to induce them to press for defensive aggressive wage and price increases just so that they will not be caught on the wrong foot if the rate of inflation which materialises actually turns out to be higher than excpected. As a result the rate of inflation does indeed rise to a level higher than anticipated and spurs the government to trim its public expenditure programme. But at this late stage this

measure has only limited success. For although the strain on the economy's resources recedes and the original inflationary source disappears, the price system has become imbued with an upward bias. Disequilibrium accelerates as inflationary expectations induce a whole series of defensive and defensive aggressive wage and price increases which result in inflation being continuously transmitted in increasing magnitude from one sector of the economy to the other.

Nowadays when governments in the West take action to stem inflation on lines advocated by traditional economic theory, they succeed in reducing inflation slightly by eliminating the more traditional economic causes. But they do not succeed in eliminating inflation entirely because they are unable to act against the real root causes of the new inflation, namely trade unions and wage-earners on the one hand and large corporations on the other hand. When they find that, beyond a certain point, anti-inflationary policies are only succeeding in increasing unemployment without reducing inflation further, they reverse policy direction. Consequent reflationary policies may reduce unemployment slightly, but they interact via expectations with the deeprooted structural factors described to bring about a new marked increase in the rate of inflation. Because of the ever-increasing disequilibrium described, it is then found in turn that beyond a certain point reflationary policies no longer assist in reducing unemployment but merely fuel additional inflation. This is the dilemma facing economic policy-makers today.

VII – INCOMES POLICY

If governments were actually to try and act effectively against the labour or corporate sectors to limit their demands, they could find themselves out of office. This factor, coupled with the relative inefficacy of anti-inflationary measures which are based on the workings of the price system, has encouraged Western governments increasingly to turn to anti-inflationary measures not based on the equilibration of prices. The result has been a tendency to look for salvation towards incomes policy in the form of wage and price controls.

However, it has been found that not only do wage and price controls eventually cause bad distortions in the economy's relative wage and price structure, necessitating rationing, but when the controls are lifted, inflation increases dramatically again – as wages and prices recoup in double quick time the levels they would have attained originally had the incomes policy not been imposed in the first instance. Thus the only way in which an incomes policy can hope to work is if it is imposed permanently. But if it is imposed permanently, this can result in a backlash from trade unions agitating against the fixity of wage differentials and from consumers reacting against peace-time rationing. Control over the community has to be strengthened by the government and these controls themselves require further controls, with the resultant defeat of the original aims of the incomes policy. A Western society that might resort to a permanent wage and price freeze policy, accompanied as it becomes in the long term by central planning, the rationing of goods and services, and social controls to implement these, is in fact departing from a capitalistic system in favour of pure socialism.

VIII – MONETARIST ARGUMENTS TO EXPLAIN PERMANENT INFLATION

The most widely held argument used to explain the permanent inflation of the past quarter century not based on a hypothesis which lays the blame on the development of certain institutional factors, is the monetarist or quantity theory of inflation. It attributes all inflation to growth in the quantity of money exceeding growth in output. In summary "too much money chases too few goods" so that money loses its value and prices rise. It follows that the quantity theory is based on a conventional price system in which wages and prices are determined by true equilibrium between supply and demand. Monetary restraint directed at reducing demand is therefore advocated as the correct measure to adapt to control inflation.

Quantity theorists derive inspiration for their theory from the close empirical relationship between changes in money supply and prices. They attribute the close relationship between wage increases and inflation, not to direct causality of the former on the latter, but to the fact that institutional wage increases create unemployment which induces governments to increase the quantity of money and it is the latter which causes prices to rise. Against this, those who argue that permanent inflation and unemployment arise at the core from downward rigidity of wages and prices resulting from labour and corporate power, point out that it is the wage/price spiral which induces governments to increase the money supply in order to prevent the creation of unemployment. In other words the basic difference between the two schools of theory lies in their notions regarding the direction of causality between changes in prices and quantity of money. Since identification of the direction of causality is really impossible empirically, the debate, which has important implications from a policy angle, remains unresolved.

The quantity theory attitude to labour and corporate influence on wage and price determination is that wages and prices are no different from what they would have been in the absence of trade unions and giant corporations. However, such an attitude remains difficult to reconcile with the downward rigidity of wages and prices in evidence throughout the industrialised world and the evolution of a system of price determination in which the producer is more powerful than the consumer.

Monetarists have also tried to come to grips with the problem of permanent unemployment which has accompanied inflation by allocating an important role to expectations. They have developed theory which relates, via a time lag mechanism in expectations, the level of unemployment to the difference between the level of expected price increases and the actual price changes which materialize.

The monetarist explanation for the ever-increasing cycles of inflation and unemployment runs along the following lines: Inflation is caused in the first instance by too rapid an increase in money supply relative to economic growth. In an effort to reduce inflation the authorities reduce the growth rate in money supply. But in an economy adjusted to continuous inflation, if the supply of money stops rising as rapidly as before and the rate of price rises declines correspondingly (in line with quantity theoretical causality), the tendency is for wage increases to continue for a while because people still expect inflation to continue at the old rate. The resultant increased real wages raise unemployment since wage-earners have to be paid out of the same aggregate wage bill as before. However, when eventually the lower rate of inflation has persisted long enough to become reflected

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in expectations, expected and actual inflation once more come into line with one another at lower levels than before. Real wages stop rising and unemployment ceases to increase.

However, before such a situation is ever reached, the authorities become pressurised into reflating the economy before, as they wrongly anticipate, unemployment rises further. Monetary authorities thus resort to increasing the growth rate of money supply. Initially they succeed in their aim to reduce unemployment. The rise in money supply growth raises the rate of inflation to a level that outpaces prior expectations. The rate of money wage increases therefore lags behind that of price increases. This in turn implies a fall in real wages and results in a corresponding decline in unemployment. But unemployment declines only for as long as inflationary expectations of wage-earners lag behind actual price increases. Thereafter, further increases in the growth rate of money supply merely push up prices without reducing unemployment any further.

Monetary theorists therefore lay the blame for the ever-increasing cycles of inflation and unemployment on the frequent reversals in direction of monetary policy of Western governments. The latter allow no time for expectations to distil and for lags to play themselves through when imposing monetary stringency in an effort to combat inflation.

Permanent inflation, argue the monetarists, can be eradicated gradually provided that authorities have the patience to pursue, for sufficiently long, a tight monetary policy which would entail living with a fairly high level of unemployment over this period. By gradually reducing the growth rate in the supply of money continuously over a lengthy period of time, the rate of inflation can be brought down gradually and continuously (in line with monetary theoretical causality). The continuity of the decline in inflation will affect expectations in such a way as to reduce and eventually eliminate the excess of expected over actual inflation and this will limit to bearable proportions the rise in unemployment created by such a policy.

The monetarist solution to permanent inflation and unemployment would appear nevertheless to be wishful thinking for a number of reasons.

Firstly it assumes that an economy's quantity of money can be totally controlled by a central authority. Apart from the havoc which international capital flows can play with domestic monetary control, the ingenuity of a freely operating banking and financial system is such as to find ways and means of getting round legal monetary controls, as current experience in the United States and Britain is proving.

Secondly, the monetarist solution to inflation assumes that a country's international exchange rate does not fluctuate sufficiently to affect domestic prices and hence inflationary expectations. Theoretically, relative exchange rates can only remain stable if all countries are inflating at the same rate and possess the same interest rate structure.

Thirdly, it is highly doubtful whether Western governments have the political will to pursue a longlasting deflationary policy of the kind that monetarists advocate. Even if they do, it is doubtful in any case whether they could survive such a policy.

Fourthly, and most significantly, the monetarist solution to permanent inflation assumes that a particular level of inflationary expectations can be imposed, so to speak, on the labour community so as to induce exactly commensurate wage increases. To begin with, it is questionable whether it is realistic to assume that constant expectations can be formed in the way prescribed. Inflationary expectations are often drastically upset by unforeseen developments as recent oil crises have shown. More importantly, advocated monetarist policy totally ignores the fact that, irrespective of what expectations about inflation are held, in a world in which the future is uncertain, the wage-earning and corporate communities, with their wage and price fixing capability, will hedge against uncertainty by bringing about wage and price increases which are slightly higher than the expected rate of inflation.

It can be seen from the aforegoing that monetarist anti-inflationary policy denies the incidence of aggressive, and more importantly, defensive aggressive wage and price increases. However, the implication in the theory of the notion that wage increases are determined by price expectations formed on the basis of past inflation experience is that all wage increases are of the defensive kind. But even if all wage increases merely correspond to past inflation an upward bias still exists in the aggregate wage structure, because, as explained earlier, a fall in relative wages in one sector can only come about through a further rise in all other wages. Thus even monetarist expectations theory is not totally compatible with a classical price system and traditional anti-inflationary policy.

The anti-inflationary policy described above which is advocated by monetarists indeed represents a concerted attempt at finding a solution to the problem of permanent inflation. But as rigorous and consistent as its derivation might be, it rests on assumptions which do not hold in practice.

Some monetarists would tend to agree with such an opinion themselves. At the same time, however, they would argue that the essence of monetary theory is that money does not affect anything real in the economy in the long term. Implicit in their approach, therefore, is the notion that although inflation cannot be cured, it is really quite harmless in the first instance. In support of this notion one could argue that capitalism has already developed its own ways of living with inflation and unemployment and that the adverse effects which these have generated have really proved to be far milder than one might have anticipated a decade or so ago.

IX – THE PHILLIPS CURVE

A discussion about the problem of inflation and unemployment is incomplete without mention of the so-called "Phillips Curve". Phillips Curve theory is based on the empirical inverse monotonic curvilinear relationship between the level of unemployment and the rate of change in money wages that was discovered by A. W. Phillips when he analysed the unemployment and money wage rate figures of the United Kingdom from 1862–1957.

Shaped in the form of an ordinary demand curve, the Phillips Curve suggested that equilibrium between supply and demand does indeed hold in normal fashion in the labour market. This market need not, therefore, be in disequilibrium and instilled with an upward bias arising out of the development of labour institutions during the course of the twentieth century. Implicit in the theory developed around the Phillips Curve was the optimistic

The Phillips Curve

% change in money wages

0
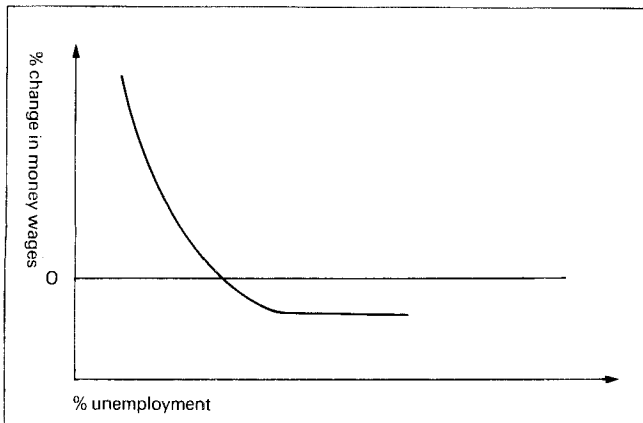
% unemployment

suggestion that deflationary measures could succeed in reducing wage increases and hence inflation by creating a sufficiently high level of unemployment.

From the time Phillips first published his article, empirical investigation into the validity of the Phillips Curve and the theoretical development of the relationships concerned have been a popular avenue for economic research. Several different kinds of adjusted Phillips Curves have been proposed and tested, incorporating such factors as expectations and unionisation. Analysis of these models has exposed a wave of contradictory ideas and findings and is beyond the scope of this paper. After two decades of continuous debate, the current state of thinking is tending towards the opinion that the Phillips Curve has become obsolete over the past two decades. Nowadays current opinion is that if any relationship between unemployment and wage increases does exist, it is between unemployment and real, not money, wages.

X – INTERNATIONAL TRANSMISSION OF INFLATION

One of the arguments used to dispel the notion that the permanent inflation currently being experienced by capitalism is an insoluble problem in the context of the existing economic and social structure of Western society is that some Western countries, most notably Germany and Switzerland, have managed to keep their rates of inflation at relatively low levels. Therefore, it is argued, the problem does not embrace all of capitalism and is peculiar only to certain countries.

There can be little doubt that much of the relative success of countries like Germany and Switzerland in keeping down inflation lies in a combination of high relative productivity and responsibility in wage determination. This has enabled labour supply in these countries to be relatively greater and closer to equilibrium with labour demand than in other countries. Accordingly, the disequilibrium and upward bias in their labour markets has been limited and hence so too their rates of inflation. Additionally, because their price structures have had less inbuilt disequilibrium, traditional anti-inflationary measures, based on an equilibrium price system, have proved relatively more effective.

More recently, however, an additional aspect has appeared as a large contributory factor in its own right to the disparity in international inflation rates. Relative exchange rates appear to have become determined as much by international political, financial and monetary

factors as by relative inflation rates. International monetary theorists are rapidly coming to the conclusion, which contradicts classical theory, that the exchange rate is more instrumental in determining prices than vice-versa in the short term. Over the past few years a significant proportion of the reason for the relatively low German, Swiss, and more recently Japanese, inflation rates can be atributed not to high productivity and responsible labour institutions, but to the strength of their currencies. These factors are all still very interdependent in the long term. But to the extent that exchange rates have come to move independently of domestic inflation rates, to that extent are countries finding it increasingly difficult to insulate themselves from the international transmission of inflation. Thus, for example, despite a relatively high actual and expected inflation rate in Britain, sterling has been strong for a number of reasons related to monetary and energy matters. Accordingly the large upward bias and disequilibrium in the British labour market has been exported to other countries.

In a world in which inflation can become transmitted internationally in the way described, as long as some significant countries possess institutional factors which instil an upward bias into their wages and prices, the aggregate world price structure necessarily becomes imbued with an upward bias and disequilibrium. In support of such an argument one need only point out that despite currency strength, high productivity, responsible labour unions and relatively stringent anti-inflationary policies, Germany and Switzerland have been experiencing persistent inflation during the past two decades. Although their rates of inflation have been low by international standards, they have nevertheless remained positive throughout and have been high from a historical point of view for these countries.

XI – CONCLUSION

The problems of permanent inflation and unemployment besetting capitalism in its present shape can be attributed at heart to institutional and structural factors which reflect the rise in labour power and the growth of giant corporations during the course of this century. The system of wage and price determination has been altered in such a way as to disrupt the classical price mechanism by imbuing it with an upward bias and disequilibrium caused by downward inflexibility of wages and prices.

There are indeed several other factors to which inflation can be attributed. But the problem would not have assumed permanent proportions were it not for the way in which these factors have interacted through expectations with increased labour and corporate power. Policy solutions based on traditional theory succeed in eliminating those causes of inflation which emanate basically from demand exceeding supply but are ineffective against the deeprooted institutional factors outlined. Against the latter only incomes policy can prove effective, but for this to be the case it has to be imposed permanently. In the long run this implies that Western economies need to become centrally planned, requiring a web of controls on society's freedom of action.

Capitalism in its present form is thus faced with an unenviable choice between continually escalating inflation and unemployment on the one hand, or total disintegration in favour of socialism on the other. A ray of optimism is provided by those willing to argue that capitalism has shown remarkable resilience in past years in adapting itself to conditions of permanent inflation and

unemployment and is therefore quite capable of coping with the problem in future years, even if it cannot be cured.

XII – SOME NOTES ON SOUTH AFRICAN INFLATION

(i) South Africa is in a unique position in the Western world, being dependent on major sources of income which are in themselves outstanding hedges against permanent inflation. Theoretically this should help in providing greater economic stability than is the case for most other countries.

(ii) It is impossible to close the interracial wage gap artificially without fuelling inflation unless these are commensurate increases in the relative productivity of non-white labour or reductions in the real wages of white wage-earners.

(iii) To the extent that many of the country's prices are administered by public bodies and corporations which increase, but seldom reduce, prices, South Africa has a built-in upward bias in its price system. Given the existence of these organisations and their methods of price determination, they should at all times endeavour to delay raising prices for as long as possible. This will delay the rise in inflationary expectations and consequently can have a snowballing effect in delaying and possibly even preventing some of the inflation.

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By J. P. Botha

The random walk model and the behaviour of gold prices: a note

I INTRODUCTION

During recent years a considerable amount of evidence has been produced to demonstrate that in a highly competitive and organised market, price changes will be close to random.[1] Prices in such markets are said to be "weakly efficient", a phrase used to describe a certain kind of statistical behaviour in a price's time series. A price is weakly inefficient if the historical price series suggests information about this series in the future; weakly efficient if the price follows a random walk.
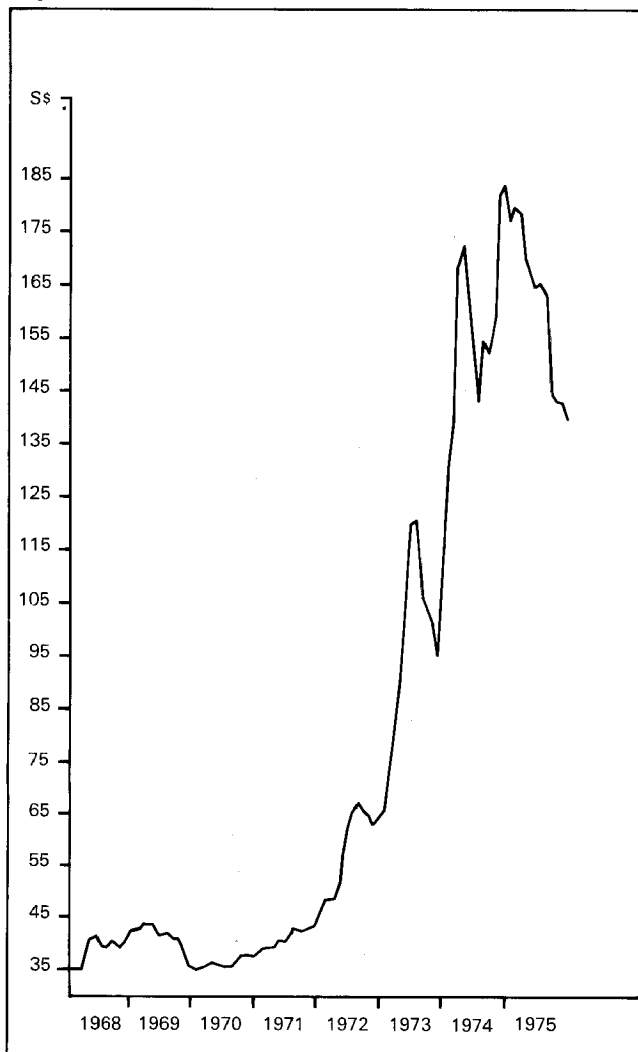
Thus, the underlying economic rationale for the random walk hypothesis is that in an efficient market, characterized by many well-informed, profit maximizing participants, competing actively with one another to predict future market values, a series of price changes has

Figure 1: Gold price 1968–1975

no memory – that one cannot predict future price changes on the basis of the history of price behaviour.

Most of the tests of the random walk model have been performed on stock markets, but a model of this nature is of interest in the analysis of gold markets. In an efficient gold market, the price of gold can be expected to approximate its "intrinsic" value because of events that have occurred in the past and as a result of events which are expected to take place in the future. Essentially then, the random walk model implies that the gold price will fluctuate randomly around its intrinsic value. This intrinsic value may change across time. If the market is efficient then the price will rapidly adjust to wander about its new intrinsic value.

Since April 1968 (with the exception of a few months in 1970) the price of gold has been free to vary (Fig. 1) and up to September 1975, the average annual rate of appreciation was about 17%. We wish, then, to examine the nature of daily gold price changes in London over this sample period and to ask if the gold market is efficient in the technical sense of that phrase.

II THE MODEL

The random walk is a stochastic process in which each successive change in the variable is drawn independently from a probability distribution with mean zero. The variable Z_t then evolves according to:

$$Z_t - Z_{t-1} = U_t$$

or

$$Z_t = Z_{t-1} + U_t$$

where, for our purposes, Z_t is the price of gold at time t and where U_t is a random variable with mean zero and is drawn independently every period, thus making each successive step taken by Z random. A drift is built into the random walk model by adding a constant, a, each period
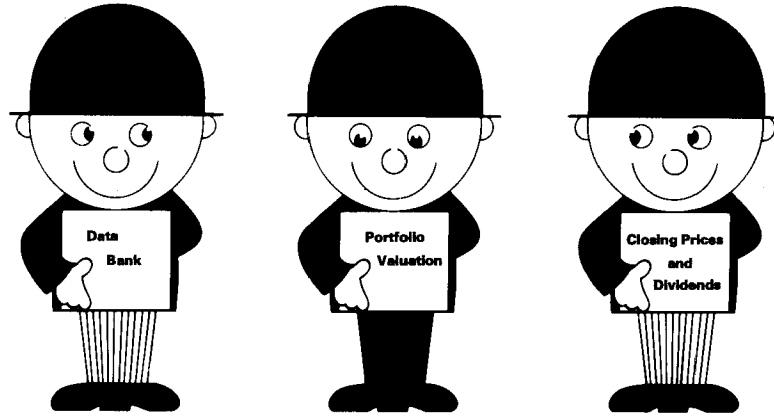
$$Z_t = Z_{t-1} + U_t + a$$

which means that on the average the process will tend to move in the direction given by the sign of the constant.

In order to examine the random walk model in the context of the gold market we have to consider the hypothesis that successive price changes are independent and that the price changes conform to some probability distribution.
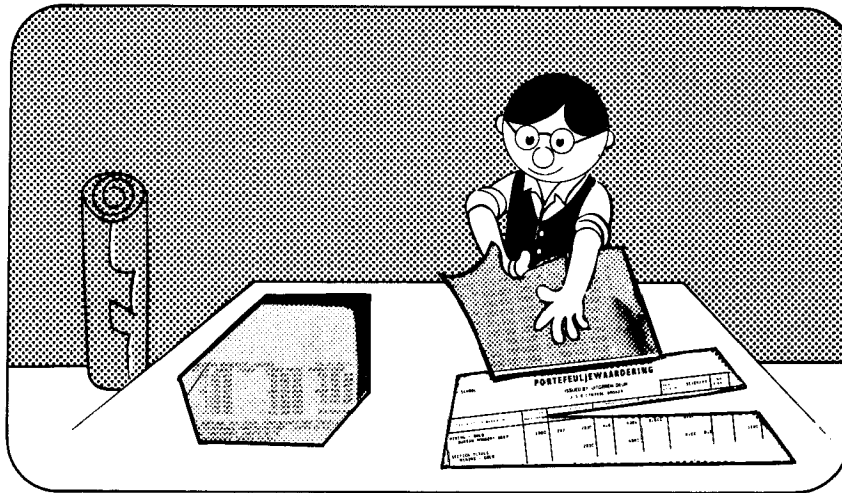
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1 P. H. Cootner (Ed.), *The Random Character of Stock Market Prices* (Cambridge, Mass.: MIT Press, 1964); E. F. Fama, "The Behaviour of Stock Market Prices", *Journal of Business*, vol. 38, 1965 pp. 34 – 105; J. F. Affleck-Graves and A. H. Money, "A Note on the Random Walk Model and South African Share Prices", *The South African Journal of Economics*, 43, Sept. 1975) pp. 382 – 388; E. F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work", *Journal of Finance*, vol. 25 (May 1970) pp. 383 – 417.

III THE DATA

In March 1968 unprecedented demand by speculators and investors led to the immediate liquidation of the official Gold Pool. The Washington agreement by Central Bank members of the Gold Pool resulted in the segregation of monetary gold stocks and the re-introduction of a free market. From the end of 1969 to the end of 1973 the IMF put a floor under the price of gold by agreeing to make purchases of newly mined South African gold when the free market quotation was $35 or below for amounts necessary to meet the Republic's need for foreign exchange. But except for that agreement, which proved necessary only for a few months in the beginning of 1970, the gold markets have been free for the past eight years. Gold prices in London are "fixed" twice daily at 10h00 and 15h00, as from April 1, 1968, to reflect the balance of supply and demand on the books of five leading bullion houses at those hours.

The data[2] which will be used consist of daily prices at 15h00 and the time period runs from April 1, 1968 to September 26, 1975. The tests are performed on the data for each individual year from 1968 through 1975 as well as on the data covering the time period April 1968 to September 1975.

The actual tests in this paper are not performed on the daily prices themselves, but on the variable U_t defined as:

$$U_t = \log_e Z_t - \log_e Z_{t-1} - V \quad t = 1,2,...N$$

where Z_t is the price of gold per ounce at day t over N sample observations, U_t is a random variable and V is a constant. It is assumed that $E(U_t) = 0$ and $E(U_t; U_{t+k}) = 0$ for lag = 0 if the random walk hypothesis is true.

The transformation to logarithms has been argued in the literature to be more appropriate because:[3]

(i) the change in the logarithm of price is the yield, with continuous compounding, from holding the share for that day;

(ii) the absolute magnitude of price changes is an increasing function of the price level of the share and by taking logarithms we neutralize most of the price level effect;

(iii) for relatively small price changes the change in the logarithm of price is close to the percentage price change.

IV THE EMPIRICAL RESULTS

Our approach relies primarily on statistical tools such as autocorrelation coefficients and analysis of runs of consecutive price changes of the same sign. In addition, we examine the distributional evidence concerning the probability distribution governing the price changes.

Autocorrelation

The autocorrelation coefficient is a measure of the relationship between the value of a random variable at time t and its value k periods earlier. An estimate of the kth lag autocorrelation is [4]

$$r_k = C_k/C_0$$

where $C_k = 1/N \sum_{t=1}^{N-k}(U_t - \bar{U})(U_{t+k} - \bar{U})$ k = 0,1,...k

is the estimate of the autocovariance and $\bar{U}$ is the mean of the time series.

The autocorrelation coefficients were computed for lags of k = 1,2...20 days to determine if any correlation exists and are shown in Table 1 for lags of up to ten days. For the random walk hypothesis to hold, each correlation coefficient should not be significantly different from zero and there should be no pattern to the sign or the size of these coefficients.

Examination of these results show that the sample autocorrelation coefficients are relatively small in absolute values and that only 16 of the 180 computed autocorrelations were more than twice their computed standard error. Since a significance level of approximately 5% (2 standard errors) was used, it is reasonable to expect that 5% of the computed autocorrelations would be more than 2 standard errors from zero, under the null hypothesis. Thus one would expect about 9 of the computed autocorrelations to be "significant". However, 16 were observed which might indicate a very slight dependence.[5]

As far as the signs of the coefficients are concerned we find that of the ninety coefficients reported in Table 1, forty-six have negative signs and forty-four have positive signs. There is some evidence that for the yearly coefficients (but not for the whole sample period coefficients) the first four lags resulted in more negative

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[2] The data used in this study were collected from Metal Bulletin, Richmond, Surrey: Simpson and Co. Ltd. 1968-1975.

[3] See e.g. Fama (1965) op. cit.

[4] G..E. P. Box and G. J. Jenkins, *Time Series Analysis: Forecasting and Control* (San Francisco: Holden - Day Inc., 1970).

[5] $(1/N^{\frac{1}{2}})$ supplies an approximate upperbound for the standard errors (Box and Jenkins, op. cit.) which implies that for a sample of almost 1 900 observations, that is the whole sample period, a coefficient as small as ,05 is more than twice its standard error so that statistically "significant" deviations from zero may not necessarily be a basis for rejecting the independence assumption.

Table 1
DAILY AUTOCORRELATION COEFFICIENTS FOR LAGS ONE TO TEN DAYS

Year	Lag (Days)									
	1	2	3	4	5	6	7	8	9	10
1968	-,062	0,029	-,054	-,015	-,002	0,005	0,100	0,039	-,096	0,031
1969	-,153*	-,053	0,134*	-,130*	0,068	0,118	-,080	0,108	0,104	0,026
1970	-,095	0,042	-,054	0,080	-,004	-0,060	-,136*	-,038	0,023	0,044
1971	0,010	0,021	-,021	-,074	0,066	0,030	-0,048	-,070	0,029	0,067
1972	-,029	-,157*	-,081	0,022	0,037	0,084	0,012	-,069	-,044	-,008
1973	0,133*	-,091	-,087	-,008	0,013	0,141*	0,049	-,074	-,035	-,028
1974	-,040	-,077	-,041	-,001	0,056	-,033	0,070	0,025	-,028	0,040
1975	-,063	-,145*	0,075	-,052	0,002	-,034	0,001	0,071	-,023	0,021
1968-75	0,032	-,072*	-,030	0,0	0,026	0,056*	0,054*	-,012	-,013	0,012

The star (*) indicates sample estimates more than twice their computed standard error.

terms than positive terms. However, since the coefficients for the 1968-1975 sample period do not show a marked preponderance of positive or negative signs we conclude that any "pattern" is only due to random fluctuations. Furthermore, since neighbouring estimates of the autocorrelations generally covary, the sample auto-correlations display a rather smooth cyclical tendency that is not present in the true autocorrelation function.

It is worth noting that the time span 1968-1975 exhibits a lack of autocorrelation greater than that for each individual year.

The coefficients are very small and close to zero for all the lags.

In sum, the evidence produced by the autocorrelation coefficients seem to indicate that dependence in successive price changes is very slight with no marked preponderance of negative or positive signs. This suggests that the assumption of zero autocorrelation is valid for the behaviour of gold prices over the lags and the time period considered.

Runs test

Very little is known about the distribution of the serial correlation coefficients when price changes do not follow a normal distribution and to test the randomness of the sequence of price changes we use a nonparametric method – the runs test. A run is defined as a period of time over which the change in prices is in the same direction, either upward or downward. The purpose of this test is to determine if the number of consecutive days of price changes in any direction conforms to that merely due to random fluctuations. This test is thus testing the same aspect of the random walk model (viz the independence of successive price changes) as the previous analysis of the autocorrelation coefficients.

Under the hypothesis of independence and for a large number of observations, N, the expected number of runs, R, of all signs can be computed as[6]

$$E(R) = (2n_1n_2/n_1 + n_2) + 1$$

where n_1 is the number of price changes in one direction and n_2 is the number of price changes in the other direction. The variance of R is

$$var (R) = \frac{2n_1n_2 (2n_1n_2 - n_1 - n_2)}{(n_1 + n_2)^2(n_1 + n_2 - 1)}$$

and for large N the sampling distribution of R is approximately normal.

Table 2 shows the total expected and actual number of

Table 2
RUNS ANALYSIS

Year	Expected R	Actual R	Z values	(R-E(R))/E(R)
1968	97	92	-0,73	-0,5
1969	124	136	1,14	,09
1970	127	114	-1,69	-,10
1971	124	118	-0,87	-,04
1972	123	104	-2,55	-,15
1973	126	118	-1,01	-,06
1974	127	125	-0,27	-,01
1975	89	101	1,76	,13
1968-1975	943	912	1,43	-,03

runs for each year and for the time span 1968-1975 with a one day differencing interval. The amount of dependence implied by the runs test is given by the difference between the expected and actual number of runs. This difference is expressed by the standardized normal variable Z, with mean zero and variance one. The column labelled (R-E(R))/E(R) gives the difference between the actual and expected number of runs as proportions of the expected numbers. Except perhaps for 1972 these percentage differences are quite small.

The hypothesis that the number of runs was realized by a random process is rejected only for 1972 where the actual number of runs is more than two standard errors less than the expected number of runs. In sum, the results of the runs analysis tend to substantiate the hypothesis of independence of successive price changes.

Distributional evidence

A last issue of the random walk model has centered on the nature of the distribution of price changes. If transactions are fairly uniformly spread over time and if the number of

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[6] A. M. Mood and F. A. Graybill, Introduction to the Theory of Statistics (McGraw-Hill Co. Inc., New York, 1963). The runs test used allows for only two types of movement (i.e. up or down) and all zero changes are regarded as "ties" and are ignored.

Table 3: Unit normal and empirical relative frequencies

	0-0,5S	0,5-1,0S	1,0-1,5S	1,5-2,0S
Unit normal	0,3830	0,2996	0,1838	0,0881
Annual average	0,5702	0,2421	0,0853	0,0449
1968-1975	0,6624	0,1629	0,0757	0,0429
Fama	0,4667	0,2802	0,1378	0,0631

	2,0-2,5S	2,5-3,0S	3,0-4,0S	4,0-5,0S	>5,0S
Unit normal	0,0331	0,0097	0,002638	0,0000614	0,0000006
Annual average	0,0276	0,0096	0,010768	0,0039668	0,0055396
1968-1975	0,0211	0,0096	0,014288	0,0073416	0,0037037
Fama	0,0278	0,0130	0,008359	0,0018778	0,0011632

transactions each day is large then, appealing to the Central Limit Theorem, we would expect that the daily price changes will have a Gaussian distribution.

We performed the usual tests for normality such as goodness of fit and analysis of extreme areas. In the goodness of fit test our hypothesis of normality was rejected for every period considered.

Table 3 shows frequency distributions for changes in the price of gold. The empirical proportions of price changes between certain given standard deviations from the mean are reported in row three for the period 1968-1975, while row two gives the empirical average annual proportions of price changes over the sample period.

Figure 2: The normal curve and the empirical distribution of price changes 1968–75
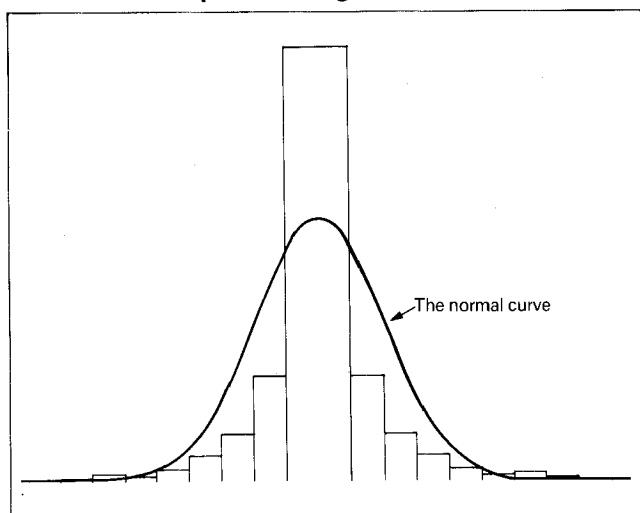
To compare these findings with the expected proportions of price changes if the distribution was exactly normal, row one gives the proportions for the unit normal distribution. Row four gives Fama's[7] findings of the distribution of stock price changes on the New York Stock Exchange. If the number in row one is smaller than those in the other rows, it should be interpreted as an excess of relative frequency in the empirical distribution over what would be expected for the given interval if the

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[7]Fama (1965) op. cit. Table 1.

distribution was normal. Similarly, if the number in row one is larger than those in the other rows, it should be interpreted as a deficiency of relative frequency in the empirical distribution within that given interval.

A consistent departure from normality is the excess of observations near the mean so that the empirical distributions are more peaked in the centre and have longer tails than the normal distribution. These findings are in the direction of the results obtained by Fama but with an even more marked degree of leptokurtosis suggesting that some non-normal distribution will provide a better description of daily price changes than the normal (Fig. 2). This aspect of the random walk model, while of interest, is not of great importance. The importance of the random walk model stems from the fact that future price changes cannot be predicted from the history of price changes alone, no matter what their distribution.

V CONCLUSION

The purpose of this paper has been to test empirically the random walk model of gold price behaviour. Our basic conclusion is that the random walk model offers a satisfactory explanation of the movement of daily price changes. The data show almost no tendency for dependence as is evidenced by examining sample autocorrelation functions – a finding which is in general substantiated by an examination of runs. The distributional evidence suggests that the distribution of daily price changes is not normal and that there is some (unspecified and perhaps unknown) non-normal distribution which is more suitable.

If successive price changes are dependent then the sequence of price changes prior to any given day is important in predicting the price change for that day. Thus the way to predict prices, under the assumption that history tends to repeat itself, is to develop a familiarity with past patterns of price behaviour in order to recognize situations of likely recurrence.

The empirical results indicate considerable support for the random walk model. The price reflects all the information available to participants in the market and all changes in the price are independent of any past history of the price. Except for a trend related to the desired rate of return, future prices could just as well be estimated by the flip of a coin (unless private information is available) as by any elaborate and detailed analysis of past prices.

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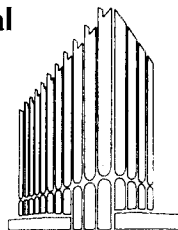
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By I. J. Lambrechts and F. J. Mostert

An analysis of the behaviour of market prices during rights issues

1 INTRODUCTION

A rights issue results in a pre-emptive right to existing shareholders in order to obtain additional shares (of the same kind as the shares already being issued) pro rata to existing ownership. The subscription price of the additional shares is generally lower than the market price. The existing shares are sold cum rights from the announcement of the rights issue until the last date for registration (LDR) as a shareholder of the company and ex rights from the LDR until the closing of the offer. An investigation was carried out in order to study the behaviour of share and rights prices and to determine:

(i) The trend of the market prices of the existing shares compared to that of the sectoral indices during the cum rights period.

(ii) The changes in market prices of the existing shares compared to those of the sectoral indices when shares become ex rights.

(iii) The extent to which changes in the market prices of the shares during the ex rights period are reflected in the market prices of the letters of allotment.

2 DISCUSSION OF METHOD OF ANALYSIS

Details of rights issues of about one hundred listed companies which made rights issues during the period 1969 to 1974 were collected. The details of each undertaking were summarised in the following way:

ROW		
1	COMPANY	EXAMPLE LTD.
2	SECTOR	FISHING
3	S	300
4	$1/_N$	2/5
	DATES: (YEAR = 197X)	
5	Two months before LDR	2/3
6	LDR	2/5
7	Just after LDR	5/5
8	Two weeks after LDR	16/5
	MARKET PRICES OF SHARES	
9	Two months before LDR	440
10	LDR	600
11	Just after LDR	608
12	Two weeks after LDR	560
	CUM DIVIDEND PERIODS	
13(a)	Declared on...................	5/5
(b)	LDR for dividends	2/6
14(a)	Declared on...................	15/9
(b)	LDR for dividends	19/10
	DIVIDENDS DECLARED (cents)	
15	Rows 13(a) and 13(b)	8
16	Rows 14(a) and 14(b)	4
	ADJUSTED MARKET PRICES OF SHARES AND PERCENTUAL CHANGES	
17	Two months before LDR	440
18	LDR	600
19	Just after LDR	600
20	Two weeks after LDR	552
21	Percentual change until LDR	+36,4
22	Percentual change after LDR (Rows 18 and 20)	−8,0
23	CHANGES IN MARKET PRICES PER LETTER OF ALLOTMENT (Row 20 − Row 19)	−48
	MARKET PRICES OF LETTERS OF ALLOTMENT AND CHANGES	
24	Just after LDR	270
25	Two weeks after LDR	230
26	Row 25 − row 24	−40

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	SECTORAL INDICES AND PERCENTUAL CHANGES	
27	Two months before LDR	138,8
28	LDR	210,8
29	Two weeks after LDR	198,5
30	Percentual change until LDR	+51,9
31	Percentual change after LDR	−5,8
32	THEORETICAL PERCENTUAL DECLINE IN MARKET PRICES OF SHARES AS A RESULT OF THE SHARES BECOMING EX RIGHTS	14,3
33	THE DIFFERENCE BETWEEN THE PERCENTUAL CHANGE IN THE MARKET PRICES OF SHARES AND THAT OF THE SECTORAL INDICES IN THE TWO MONTHS UNTIL THE LDR	−15,5
34	THE DIFFERENCE BETWEEN THE PERCENTUAL CHANGE IN MARKET PRICES OF SHARES FROM LDR UNTIL TWO WEEKS AFTER LDR AND THAT OF THE SECTORAL INDICES (Row 22 + Row 32 − Row 31)	+12,1
35	EX RIGHTS PERIOD: DIFFERENCE BETWEEN CHANGES IN MARKET PRICES OF SHARES AND CHANGES IN MARKET PRICES OF LETTERS OF ALLOTMENT (Row 23 − row 26)	−8
36	RESULT OF ROW 35 EXPRESSED AS A PERCENTAGE OF THE MARKET PRICES OF LETTERS OF ALLOTMENT JUST AFTER LDR (Row 24)	−3,0

The origin of some of the information contained in the above table is evident. It is however necessary to explain briefly the origin/way of calculation of certain items:

Row 3: S = subscription price (obtained from "The Johannesburg Stock Exchange Monthly Bulletin").

Row 4: N is the number of rights required to subscribe to one new share. As each existing share has only one right, $1/N$ equals the ratio of new shares to existing shares. This information was also obtained from The Johannesburg Stock Exchange Monthly Bulletin.

Rows 5 to 8: These rows show the various dates on which market prices were recorded, i.e. two months before LDR, LDR, just after LDR and two weeks after LDR. LDR is normally on a Friday and those in row 7 on a Monday.

Rows 9 to 12: Market prices of existing shares on the dates recorded in rows 5 to 8. Various rules were applied if a market price was not available on a specific date, but these are not relevant for the purpose of this article.

Rows 13 to 16: The cum dividend periods (between the declaration date and LDR) for the first dividends during the calendar year appear in rows 13(a) and (b) and those of the second dividends in rows 14(a) and (b). The amounts of the respective dividends appear in rows 15 and 16.

Rows 17 to 20: If the market prices in rows 9 to 12 were recorded during cum dividend periods the applicable dividend amounts were deducted from the market prices to arrive at ex dividend prices.

Row 21: This row shows the percentual change in the market prices from the announcement of the rights issue until the LDR.

Row 22: The percentual change from the LDR until two weeks after LDR.

Row 23: This row shows the change in the market prices of shares per letter of allotment (or per share). The following example illustrates the method of calculation and the justification for it. Assume that the market price per share increases from just after LDR until two weeks after LDR with 35 cents. As formulated in the discussion of row 4, N equals the number of rights required to subscribe for one new share. This should theoretically result in an increase of the market price per right of $\frac{35}{N}$ cents, because the theoretical market value of a right in the ex rights period $= \frac{M-S}{N}$, where M is market price and

the other symbols have the same meaning as above. Furthermore, N rights are combined to form one letter of allotment. The increases of the market per letter of allotment therefore equals $(\frac{35}{N} \times \frac{N}{1})$, i.e. 35 cents. A change in the market price per share is therefore equal to a change in the market price per letter of allotment. The reason why the words "per letter of allotment" are used, is to indicate that the changes in this row are comparable to the changes in the market prices of the letters of allotment as it appears in row 26.

Rows 24 and 25: These rows show the market prices of the letters of allotment on the applicable dates.

Row 26: The change in the market prices of the letters of allotment is calculated.

Rows 27 and 29: These rows show the sectoral indices (obtained from the "Rand Daily Mail").

Row 30: The percentual change of the sectoral indices during the two months before the LDR.

Row 31: The percentual change of the sectoral indices during the two weeks after LDR.

Row 32: The theoretical percentage decline in the market prices of the existing shares as a result of the shares becoming ex rights is shown in this row. The following formula was used to calculate the decline:

$$D = \frac{M-S}{M(N+1)} \times \frac{100}{1}\%$$

where:

D = theoretical percentual decline in market prices,
M = market price per share during the cum rights period,
S = subscription price of the additional shares,
N = number of rights necessary to get one additional share (each existing share has only one right).

Details of row 3 and 18 as well as the reciprocals of row 4 are used for the calculation of D.

Row 33: The difference between the percentual change in the market prices of shares and that of the sectoral indices in the two months until the LDR (row 21 − row 30).

Row 34: The difference between the percentual change in market prices of shares from LDR until two weeks after LDR and that of the sectoral indices. To calculate the change in the market price of a share the actual change and the theoretical change (as a result of shares becoming ex rights) are taken into account, i.e. row 22

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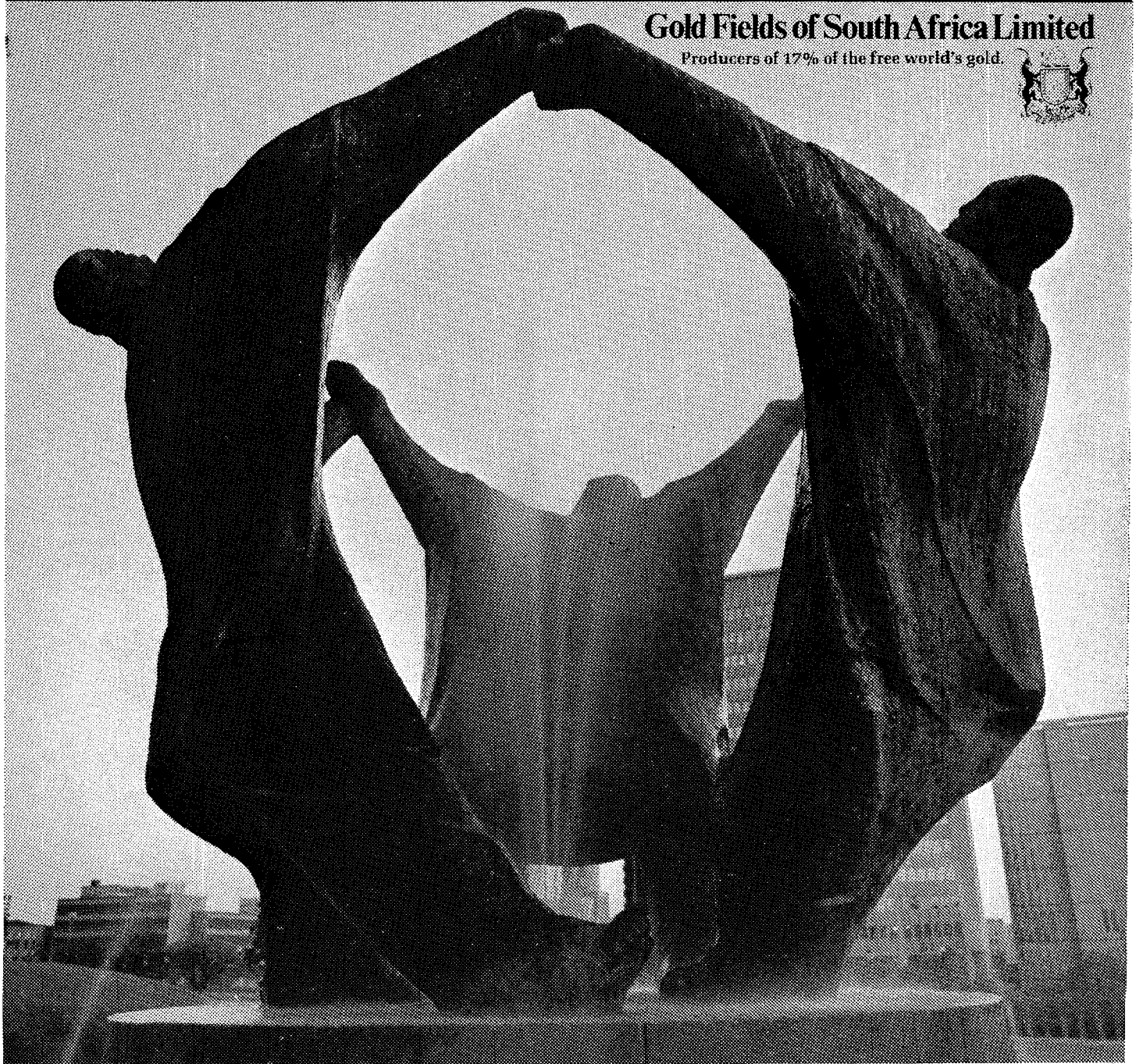
plus row 32. The sum indicates the theoretical net change of a particular share excluding the effects of it becoming ex rights, e.g. row 22 = +6,0 per cent and row 32 = 2,0 per cent (please note that in the latter case the figure indicates a theoretical decline). Therefore, had it not been for the share becoming ex rights one would have expected that row 22 would have been +8,0 per cent. If the difference between this figure (row 22 + row 32) and row 31 is zero and if the assumption is made that the share prices of companies in a sector change in line with that of the sector one could conclude that the formula on which row 32 is based, is of practical use.

Row 35: The difference between the changes in the market prices of the existing shares per letter of allotment during the ex rights period and the changes in the market prices of the letters of allotment (row 23–row 26).

Row 36: The difference between the changes in the market prices of the existing shares during the ex rights period and the changes in the market prices of the letters of allotment during the same period is expressed as a percentage of the market price of letters of allotment just after LDR.

3 RESULTS OF INVESTIGATION

A differentiation was made between rights issues which took place during the periods when the business cycle (derived from share prices) showed an upward trend and those which took place during the downward trend. To accomplish this the Rand Daily Mail industrial indices were assimilated by means of the computer in order to find the periods of upward and downward trends. This included the elimination of seasonal and accidental factors as well as the long-term trend. As expected the majority of rights issues took place during the upward phases of the business cycle.

3.1 Trend of the market prices of existing shares compared to that of the sectoral indices during the cum rights period

The figures supplying the information regarding the abovementioned trend appear in row 33 and are summarised in Table 1.

Table 1: Classification of the differences between the percentual change in the market prices of shares and those of the sectoral indices in the two months until LDR

	During upward phases of the business cycle		During downward phases of the business cycle		Total	
	Number	%	Number	%	Number	%
≥+ 20%	3	5,2	4	10,4	7	7,3
+ 15% to +19,9%	2	3,5	2	5,3	4	4,1
+ 10% to +14,9%	4	6,9	2	5,3	6	6,3
+ 5% to + 9,9%	8	13,8	6	15,8	14	14,6
+0,1% to + 4,9%	6	10,3	6	15,8	12	12,5
0%	0	0,0	0	0,0	0	0,0
−0,1% to − 4,9%	14	24,1	4	10,5	18	18,8
− 5% to − 9,9%	6	10,3	6	15,8	12	12,5
− 10% to −14,9%	6	10,3	4	10,5	10	10,4
− 15% to −19,9%	2	3,5	2	5,3	4	4,1
≤− 20%	7	12,1	2	5,3	9	9,4
	58	100,0	38	100,0	96	100,0

Note: Results were obtained for 96 companies.

This table reveals the following:

(a) During upward phases of the business cycle;
In 39,7 per cent of the cases the changes in share prices were higher than those in sectoral indices and in 60,3 per cent of the cases they were lower. Only 34,4 per cent of the cases yielded a result varying between +4,9 per cent and − 4,9 per cent.

(b) During downward phases of the business cycle;
In 52,6 per cent of the cases the changes in share prices were higher than those in sectoral indices and in 47,4 per cent they were lower. Only 26,3 per cent of the cases yielded a result varying between +4,9 per cent and − 4,9 per cent.

(c) Total figures.
Positive results were obtained in 44,8 per cent of the cases while the results were negative in 55,2 per cent of the cases. Only 31,3 per cent of the cases yielded a result varying between +4,9 per cent and − 4,9 per cent.

It can be concluded that there is no definite evidence that the announcement of a rights issue *per se* has a favourable influence on market prices of shares. Furthermore, no important difference between the results obtained during the upward and downward phases of the business cycle were obtained.

3.2 Change in market prices of existing shares compared to those of the sectoral indices when shares become ex rights.

This information was summarised in row 34. Table 2 contains an analysis of that information.

Table 2: Classification of the differences between the percentual change in the market prices of existing shares and those of the sectoral indices when shares become ex rights

	During upward phases of the business cycle		During downward phases of the business cycle		Total	
	Number	%	Number	%	Number	%
≥+ 20%	2	3,4	2	5,3	4	4,2
+ 15% to +19,9%	4	6,9	0	0,0	4	4,2
+ 10% to +14,9%	7	12,1	3	7,9	10	10,4
+ 5% to + 9,9%	7	12,1	4	10,5	11	11,5
+0,1% to + 4,9%	12	20,7	8	21,1	20	20,8
0%	1	1,7	1	2,6	2	2,1
-0,1% to - 4,9%	16	27,6	7	18,4	23	23,9
- 5% to - 9,9%	5	8,6	9	23,7	14	14,6
- 10% to -14,9%	3	5,2	2	5,3	5	5,2
- 15% to -19,9%	0	0,0	1	2,6	1	1,0
≤- 20%	1	1,7	1	2,6	2	2,1
	58	100,0	38	100,0	96	100,0

Note: Results were obtained for 96 companies.

There are not important differences between the results obtained for upward phases of the business cycle and those for downward phases. In about 47 per cent of the cases differences varying between +4,9 and – 4,9 per cent were recorded. If the market prices of shares follow the same trend as the sectoral indices the formula described in row 32 gives an approximated indication of the percentual decrease in market prices as a result of shares becoming ex rights in about 50 per cent of the cases.

3.3 The extent to which changes in the market prices of the shares during the ex rights period are reflected in the market prices of the letters of allotment

The results of row 36 where the difference between the changes in the market prices of the existing shares during the ex rights period and the changes in the market prices of the letters of allotment during the same period (expressed as a percentage of the market price of the letters of allotment just after LDR) are summarised in Table 3.

Table 3: Classification of the differences between the changes in the market prices of shares and those of the letters of allotment expressed as a percentage of the market prices of the letters of allotment just after LDR

	During upward phases of the business cycle		During downward phases of the business cycle		Total	
	Number	%	Number	%	Number	%
≥+ 20%	12	24,5	3	9,1	15	18,3
+ 15% to +19,9%	3	6,1	0	0,0	3	3,7
+ 10% to +14,9%	1	2,0	2	6,1	3	3,7
+ 5% to + 9,9%	2	4,1	1	3,0	3	3,7
+0,1% to + 4,9%	2	4,1	0	0,0	2	2,4
0%	2	4,1	3	9,1	5	6,1
-0,1% to - 4,9%	2	4,1	1	3,0	3	3,7
- 5% to - 9,9%	1	2,0	1	3,0	2	2,4
- 10% to -14,9%	5	10,2	1	3,0	6	7,3
- 15% to -19,9%	1	2,0	0	0,0	1	1,2
≤- 20%	18	36,8	21	63,7	39	47,5
	49	100,0	33	100,0	82	100,0

Note: Results were obtained for 82 companies.

If positive results are obtained it is an indication that only part of the changes in the market prices of the existing shares is reflected in the market prices of the letters of allotment. In the case of a negative result the change in the market price of the letter of allotment is higher than the change in the market price of the existing share and the conclusion could possibly be made that other factors influence the market prices of the letters of allotment. Examples of these other factors are the situation on the

money and capital market and possibly a higher marketability because of lower amounts involved. It is interesting to note that in the majority of the cases investigated, negative results were obtained. During upward phases of the business cycle about 55 per cent of the cases yielded negative results while in downward phases this figure amounted to about 73 per cent, giving a weighted total of 62 per cent. One would have expected the contrary, i.e. a higher figure for the negative results in

upward phases of the business cycle than in downward phases. This expectation arises from the fact that *theoretically* (according to the formulae which are used widely) the change (decrease in a period of decreasing share prices) in share prices would result in a greater change in the prices of the letters of allotment; a leverage effect. On the other hand one would expect that only the better undertakings would go to the market for additional ordinary share capital in a period of decreasing share prices.

4 COMMENTS

It may appear as though the results are not very encouraging, but it is necessary to emphasise the following:

(a) The survey was only done for a period of six years. A longer period may yield more significant results.

(b) The sectoral indices are weighted averages of the market prices of the companies concerned. It is therefore logical that some companies will have different trends than others, the problem with all averages.

(c) There is a possibility of time lags between the market prices of the shares and the sectoral indices. This may have an impact on the results.

(d) It is possible that seasonal and accidental factors can influence market prices. Only the impact of dividends declared was eliminated.

As this survey was nothing but an attempt to analyse the market prices of shares and letters of allotment during a rights issue, comments on the broader problems of rights issues would be appreciated.

By J. F. Affleck-Graves, A. H. Money and C. G. Troskie[1]

An empirical comparison of the performance of different stock market indices

ABSTRACT

The performance on The Johannesburg Stock Exchange of five different types of stock market indices (those based on the Dow Jones, Standard and Poors, United Press International Market Indicator, Value Line, and ESE philosophies) are compared for four different types of markets. It is shown that, after the actual type of market, the method of computing the index is a more important source of variation in the index than is the actual sample of securities chosen as constituents. Pairwise comparisons are made between the different types of indices, and the performance of the indices based on price is contrasted with that of the indices based on return.

1 INTRODUCTION

In this paper, the performance on The Johannesburg Stock Exchange of five different types of stock market indices is empirically examined. An attempt is made to compare the relative performance of the different types of indices in both bull and bear markets, and some remarks are made about their relative volatility. In addition, some other interesting results are highlighted, and some of the subjective remarks made in the literature relating to the performance of particular types of stock market indices are shown to hold in practice.

2 TYPES OF STOCK MARKET INDICES

The five methods of constructing stock market indices which will be examined in this paper, may be defined as follows:

(i) Arithmetic average of price (DJ index)

This type of index is constructed as follows:

$$I_t = 1/n \Sigma^n_{j=1} P_{j;t}$$

where

I_t is the level of the index at period t;

n is the number of securities included in the index;

$P_{j;t}$ is the price of the jth security in period t.

This is perhaps the most intuitive type of stock market index and is the methodology upon which the Dow Jones Averages are based. As far as investment is concerned, this type of index corresponds to an investor who buys one share in each of the n constituent companies.

(ii) Market capitalization index (SP index)

This type of index is computed as follows:

$$I_t = \frac{\Sigma^n_{j=1} N_{j;t}{}^* P_{j;t}}{\Sigma^n_{j=1} N_{j;o}{}^* P_{j;o}} {}^* L.F.$$

where

$N_{j;t}$ is the number of shares issued in the jth security at time t;

$P_{j;o}$ is the price of the jth security at some base period, t = o;

L.F. is a linking factor to preset the index at some desired level; and the remaining symbols are as previously defined.

This method of construction, which gives greater weight to the larger companies (those with bigger market capitalizations), has become extremely popular, especially with large investors such as mutual funds, since it takes the "availability" of the security into account. As far as investment is concerned, it is equivalent to an investor who spreads his money among the n constituents in proportion to the market capitalization of each security relative to the total market capitalization of all n companies. Some of the better known indices which use this approach are the Standard and Poor's Indices, the New York Stock Exchange Indices, the Financial Times Actuaries Index (London Stock Exchange) and the Rand Daily Mail Indices (The Johannesburg Stock Exchange).

(iii) Arithmetic average of return (UP index)

It has been argued by Cohen and Fitch[2] that since investors are generally interested in return and not usually in price *per se,* stock market indices should be based on return and not price. Most of the empirical work pertaining to stock market indices based on return has not used return in the traditional sense of the word (difference in price over some period divided by price at the beginning of the period) but have used a related measure, the price relative ($P_{j;t}/P_{j;t-1}$). Thus, this type of index is usually contructed as follows:

$$I_t = 1/n \Sigma^n_{j=1} (P_{j;t}/P_{j;t-1}) {}^* I_{t-1}$$

where the symbols are as previously defined. This index is equivalent to the performance of an investor who invests equal monetary amounts in each security and reallocates back to equal amounts at the start of each new period (whether a day, a week, a month or a year). The United Press International Market Indicator is constructed in this manner (New York Stock Exchange).

(iv) Geometric average of return (VL index)

This method has received a fair amount of attention in the more recent literature and is also based on price relatives (as for (iii) above). A Geometric Average index is constructed as follows:

$$I_t = (\pi^n_{j=1} P_{j;t}/P_{j;t-1})^{1/n} \times I_{t-1}.$$

This type of index has become known as the continuous reallocation type index since it reflects the behaviour (theoretical) of an investor who continuously reallocates his resources so as to maintain a portfolio with equal monetary amounts in each security. The most famous index using this type of methodology is the Value Line index (NYSE).

(v) The ESE indices (ESE index)

The fifth type of index which will be considered in

this paper, is an index which is peculiar to The Johannesburg Stock Exchange. It is the ESE type index, which is constructed in the following manner:

$$I_t = 1/n \sum_{j=1}^{n} \left(\frac{1\,000}{(P_{j;o})} * P_{j;t} \right) * L.F.$$

where

$P_{j;o}$ is the price of the jth security at the beginning of the current year, and the remaining symbols are as previously defined.

This type of index reflects the performance of an investor who allocates his funds equally (i.e. equal rand amounts) in each of the n constituent securities at the beginning of the year, and maintains that portfolio until the end of the year when he sells all his securities and reallocates equal rand amounts to each security. Thus, in effect, he sells part of his holdings in those securities which have performed best in the year, and purchases more of those securities which have performed worse. Clearly, this index is very similar to the UP type index with the difference being that the UP index reallocates each period that the index is computed, while the ESE index reallocates annually. It can be argued that this makes the ESE a more realistic index for the average investor, since it is unlikely that an investor would generally reallocate his funds every period (especially if the index is constructed daily, or weekly) whereas he might reallocate annually. In any case, except for a very active trader, the yearly reallocation is probably closer to reality than daily or weekly reallocation. While on the subject of reallocation and reality, it is worth noting that the market capitalization type indices, which appear to be the most popular at the present time, are not very realistic in terms of mirroring the performance of the average investor. As Levy[3] points out, the average investor is much more likely to buy either an equal number of the securities he selects (i.e. the DJ type index) or an equal number of dollars (or rands) worth (as assumed by the UP, VL and ESE indices).

3 THE DATA

In order to examine the performance of the different methods of constructing stock market indices, it was decided to draw eight random samples of 50 securities each from the 203 securities quoted on The Johannesburg Stock Exchange for which data were available (over the period 22 March 1968 to 20 June 1975). Then, for each sample, five indices were constructed – one for each method of construction considered. Thus, 40 indices in all were constructed.

In order to analyze the performance of these indices, it was decided to break the data into four distinct periods:

(i) **General bull market:** 22 March 1968 to 30 April 1969
(ii) **General bear market:** 30 April 1969 to 5 November 1971
(iii) **Gold bull market:** 5 November 1971 to 5 April 1974
(iv) **Gold bear market:** 5 April 1974 to 24 January 1975

For each of the 40 indices, the percentage return on the index was computed for each of the four periods above, using the formula

$$\frac{I_t - I_o}{I_o} \times 100$$

where

I_t was the level of the index at the end of the period; and I_o was the level at the beginning of the period.

These 160 values (returns on each of the 40 indices for each of the 4 types of markets) were used as the data for the analysis in the next section[4].

4 TESTS AND RESULTS

Initially, the data were analyzed by performing a three-way analysis of variance where the factors were:

(i) The method of construction (DJ, SP, UP, VL and ESE) which will be called the **index** effect.
(ii) The sample drawn (sample number 1 to sample number 8) – the **sample** effect.
(iii) The type of market (bull, bear, gold bull, gold bear) – the **market** effect.

It must be mentioned that in order to perform this analysis of variance, the returns on the various indices must be assumed to be normally distributed. However, while this assumption is questionable since it has been shown (Fama[5] and Affleck-Graves[6]) that the distributions appear to be Stable Paretian, it can nevertheless be argued that the data are not "too far removed" from normality (except for the tails of the distribution) and hence the analysis of variance should yield acceptable results.

The analysis of variance table is given in Table 1 below:

Table 1: Anova table for three factor model

Source of variation	Sum of squares	Degrees of freedom	Mean square	F-ratio
Index	5 051,2	4	1 262,8	10,29**
Sample	2 537,5	7	362,5	3,53**
Market	1 046 708,4	3	348 902,8	1 486,59**
Index * sample	3 435,4	28	122,7	1,19
Index * market	14 285,2	12	1 190,4	11,58**
Sample * market	4 928,3	21	234,7	2,28**
Error[7]	8 636,7	84	102,8	
Total	1 085 582,7	159		

*Indicates significance at the 5% level
**Indicates significance at the 1% level

It should be noted that the three-factor model used above is a "mixed effects" model with the **"index"** and **"market"** effects being fixed and the **"sample"** effect being random. This accounts for the entries in the "F-ratio" column in Table 1.

On examining Table 1 it can be seen that all three main effects are significant at the 1% level. However, as the **index*market** and **sample*market** interactions are also significant, interpretation is rather difficult.

Moreover, as the **index*sample** interaction is not significant (while both interactions with the **market** are significant) it was decided to analyze the data for each of the four types of markets separately. Thus, for each of the types of market, a two-way analysis of variance was performed with the two factors being **index** and **sample**. These results are presented in Tables 2 to 5 below.

Table 2: Anova table for general bull market

Source of variation	Sum of squares	Degrees of freedom	Mean square	F-ratio
Index	162,3	4	40,6	2,72*
Sample	157,4	7	22,5	1,51
Error[8]	417,2	28	14,9	
Total	736,9	39		

Table 3: Anova table for general bear market

Source of variation	Sum of squares	Degrees of freedom	Mean square	F-ratio
Index	1 563,1	4	390,8	45,44**
Sample	732,7	7	104,7	12,17**
Error	241,3	28	8,6	
Total	2 537,1	39		

Table 4: Anova table for gold bull market

Source of variation	Sum of squares	Degrees of freedom	Mean square	F-ratio
Index	17 521,0	4	4 380,3	10,80**
Sample	6 295,8	7	899,4	2,22
Error	11 356,6	28	405,6	
Total	35 173,4	39		

Table 5: Anova table for gold bear market

Source of variation	Sum of squares	Degrees of freedom	Mean square	F-ratio
Index	89,8	4	22,5	10,71**
Sample	279,9	7	40,0	19,05**
Error	57,3	28	2,1	
Total	427,0	39		

$(F_{0,95;4;28} = 2,71; F_{0,95;7;28} = 2,36; F_{0,99;4;28} = 4,07; F_{0,99;7;28} = 3,36)$

Examination of Tables 2 to 5 reveals that the **index** effect is significant at the 5% level in all four types of markets and is significant at the 1% level in three of the four markets. The **sample** effect, however, is significant (at both the 1% and 5% level) in only two of the four markets examined. Also, with the exception of the "Gold Bear Market" (Table 5), the mean square for the **index** effect is considerably larger than the mean square for the **sample** effect. This is also true for these respective mean squares in Table 1 and therefore it is argued that the **index** effect,

that is the method used in constructing the index, is a more important source of variation than the **sample** effect, that is the actual sample of securities chosen.

5 COMPARISONS OF THE DIFFERENT INDICES
In order to distinguish between the five different methods of constructing indices, it is necessary to perform pairwise multiple comparisons on the **index** effect. This was done using Tukey's method (c.f., for example, Miller[9]) and the results are summarized in Table 6 below.

Table 6: Pairwise comparison of the index effect

Type of market	Significant difference in means	Mean return on index DJ	SP	UP	VL	ESE	Result of comparison
General bull	5,62	21,25	22,62	24,25	21,37	26,62	No significant difference
General bear	4,28	−59,62	−61,12	−45,37	−54,37	−47,75	SP =DJ< VL< ESE =UP
Gold bull	29,34	175,63	168,13	154,38	115,88	162,88	VL< UP =ESE =SP =DJ
Gold bear	2,08	−29,75	−30,25	−27,12	−31,75	−29,37	VL< ESE< UP; SP =DJ< UP VL =SP =DJ and ESE =SP =DJ

The analysis of the results presented in Table 6 above, is fairly difficult and subjective since the results are not identical for each type of market. In addition, in the fourth type of market (the "Gold Bear Market") the results are somewhat contradictory – a problem which frequently occurs when doing pairwise comparisons. However, those results which it is felt are most important, are summarized below:

(i) **Indices based on price (the DJ and SP type indices)**

These indices are of interest because at present they are by far the most popular methods of constructing stock market indices. In all four types of market, no statistically significant difference in the performance of the indices constructed using those two methods, was detected.

(ii) **Indices based on return (the UP, VL and ESE type indices)**

On examining the results presented in Table 6 it can be seen that in the first three markets, no significant difference between the UP and ESE type indices was observed, while in the fourth type of market, the average return on the UP type indices was found to be greater than that on the ESE type indices. However, on studying the actual data and the means presented in Table 6, it was found that for all eight samples, in both **bull** markets (that is, markets 1 and 3) the ESE indices had higher return than the corresponding UP indices. Also, in the two **bear** markets, the ESE indices had lower return (that is, fell more) than the corresponding UP indices. Thus, since the ESE type indices appear to rise more in a bull market and fall more in a bear market, it can be argued that

they are more volatile than the UP indices. Hence, if one equates volatility in an index with information (the more volatile an index, the more informative it is – Feeney and Hester[10]), then it would appear that the ESE type indices are more informative than the UP type indices.

Since the geometric mean will always be less than the arithmetic mean it follows that the VL type indices will always have lower return than the UP or ESE type indices (cf. for example, Marks and Stuart[11], Latané, Tuttle and Young[12]). Thus in a rising market the VL index will rise less than the other two indices while in a falling market the VL will fall more.

(iii) **Return vs price indices**

In recent years interest in indices based on return rather than price has grown in the United States with the United Press International Market Indicator and the Value Line index being fairly widely quoted. It is therefore of interest to investigate whether there is any difference in the performance of an index based on price as opposed to an index based on return. As has been argued in (ii) above, the Value Line forms a floor for all other return indices and therefore in the analysis below it is not considered. Thus, the performance of the DJ and SP type indices is contrasted with that of the UP and ESE type indices. This can be done by testing the null hypothesis[13] that

$$\mu_{DJ} + \mu_{SP} = \mu_{UP} + \mu_{ESE}$$

against the alternative of inequality, for each of the four markets examined, using an ordinary t-test (since only one comparison is being made for each type of market). The results are presented in Table 7 below.

Table 7: Comparison of DJ and SP with UP and ESE type indices[14]

Type of market	T	D
General bull	5,59	– 7,00*
General bear	4,25	– 27,62*
Gold bull	29,17	26,50
Gold bear	2,10	– 3,51*

From Table 7 it can be seen that the two bull markets provide conflicting results. In the general bull market a significant difference between the return and price indices was found. As the sign of D is negative this implies that the return indices rose more on average than the price indices. In the gold bull market, however, no significant difference was detected, but it should be noted that the sign of D changed to positive and was close to the critical value.

The results for the two bear markets are similar with the price indices falling significantly more on average than the return indices in both instances.

Since the results above appear to indicate that there is no consistent difference between return and price indices in bull markets and that the price indices fall more on average in bear markets, these results can be said to support the oft quoted remark that indices based on return "outperform" indices based on price because of an upward bias in the return indices (cf. for example, Latané, Tuttle and Young[15]). On the other hand, if one equates volatility with information then it would appear that the price indices are superior – they rise as much as return indices in bull

markets and fall by more in bear markets and are hence more volatile. It should be noted that the above is a rather subjective remark and is not based on statistical significance.

6 CONCLUSIONS

In this paper an empirical study of some of the more popular methods of constructing stock market indices has been presented for various market conditions. A brief summary of the main conclusions which can be drawn from the above is presented below.

Firstly, the "type of market" has the most influence on the performance of an index, as is to be expected. The study revealed that for a particular type of market all methods of construction provided indices which moved in the same general direction.

Secondly, for a particular type of market, the method used in constructing the index was a more important factor than the actual sample of securities chosen. In view of this it is surprising to find on studying the historical development of the major indices that often the method of construction was fairly arbitrarily

chosen while a great deal of research was devoted to the selection of the constituent securities. This result should be carefully studied by anyone contemplating construction of a new stock market index.

Thirdly, no significant difference in the performance of the two indices based on price was detected. In fact, in the 32 cases examined (eight samples in each of four markets), the DJ (arithmetic average) type indices performed better (in terms of volatility) than the SP (market capitalization) type indices in 15 cases and vice versa in 16 cases, with one case producing identical performance. Thus there does not appear to be any empirical evidence to support preference for either of these two methods over the other.

Fourthly, study of the indices based on return reveals that the VL (geometric average) type indices are always at a lower level than either the UP (arithmetic average) or ESE (arithmetic average with yearly reallocation) type indices thus forming a "floor" for the other return indices. While this can be a useful index in certain circumstances this property is unlikely to make it popular with the average investor. It appears as if the ESE type indices are superior to the UP type indices in performance and, as the ESE indices are probably closer to the behaviour of the average investor than the UP type indices (as discussed in Section 2), it is argued that the ESE type indices are the most suitable of the three return indices examined.

Finally, comparison of the price and return indices reveals that the former are possibly slightly more volatile and hence could be considered preferable. However, this difference is not very marked (especially as far as the ESE type indices are concerned) and the individual investor should choose the index which most clearly matches his investment strategy – DJ type if he purchases equal numbers of each security; SP if a large investor and concerned about "availability"; and ESE (or UP) if equal monetary amounts are invested in each security.

In conclusion, it can be said that South African investors are fairly well catered for with the RDM indices (market capitalization (SP) indices) catering for those investors with a preference for a price index while the ESE indices are probably the most suitable for those investors requiring an index based on return.

Footnotes

1 The authors wish to thank the Council for Scientific and Industrial Research for their financial support.

2 Cohen, K. J. and Fitch, B. P. (1966): The Average Investment Performance Index. Management Science, Vol. 12, pp 195-215.

3 Levy, R. A. (1968): The Relative Strength Concept of Common Stock Price Forecasting. Investors Intelligence, N.Y.

4 Listings of this set of data are available from the authors as are lists of the actual 50 securities chosen for each of the eight samples and the population of 203 securities.

5 Fama, E. F. (1965): The Behaviour of Stock Market Prices. Journal of Business, Vol. 38, pp 34-105.

6 Affleck-Graves, J. F. (1974): Portfolio Selection on The Johannesburg Stock Exchange. Unpublished M.Sc. thesis, University of Cape Town.

7 Since there is only one observation per cell it is not possible to check for a three factor interaction.

8 Since there is only one observation per cell it is not possible to check whether the **index*sample** interaction is still zero.

9 Miller, R. G. (1966): Simultaneous Statistical Inference. McGraw-Hill, N.Y.

10 Feeney, G. J. and Hester, D. D. (1967): Stock Market Indices: A Principal Components' Analysis. In Hester, D. D. and Tobin, J.: Risk Aversion and Portfolio Choice. John Wiley and Sons, N.Y.

11 Marks, P. and Stuart, A. (1971): An Arithmetic Version of the Financial Times Industrial Ordinary Share Index. Journal of the Institute of Actuaries, Vol. 97, pp 297-324.

12 Latané, H. A., Tuttle, D. L. and Young, W. E. (1971): Market Indexes and their Implications for Portfolio Management. Financial Analysts Journal, Vol. 27, pp 75-85.

13 μ_{DJ} denotes the true mean of the returns on the DJ type indices, with μ_{SP}, μ_{UP} and μ_{ESE} being similarly defined.

14 $T = t_{28;0,975}(4{*}MS_E/8)^{\frac{1}{2}}$
$D = (\overline{DJ} + \overline{SP}) - (\overline{UP} + \overline{ESE})$ where $\overline{DJ}$ is the average of the returns on the DJ type index over all samples and $\overline{SP}$, $\overline{UP}$ and $\overline{ESE}$ are similarly defined.
*Indicates a significant difference between the price and return indices – if $|D| > T$.

15 Latané, Tuttle and Young, op. cit.

By R. W. Bethlehem

Investment basics – VI
Interest rates, yield curves and the valuation of ordinary shares

The importance of interest rates to the valuation of ordinary shares can best be illustrated by an example such as the following:

$$PV = \sum_{t=o}^{n} \frac{d_t}{(1+i)^t}$$

where: PV = present value
i = interest or discount rate
d = dividend for the period t

Present value is an essential feature of the fundamental approach to security valuation. Thus, if the summed present value of expected future dividends exceeds the ruling market price of an ordinary share, the share is to be regarded as being undervalued and, therefore, worth buying, and conversely where the summed present value is less than the ruling market price.

The equation given above is an abbreviated statement which can be expressed more fully as follows:
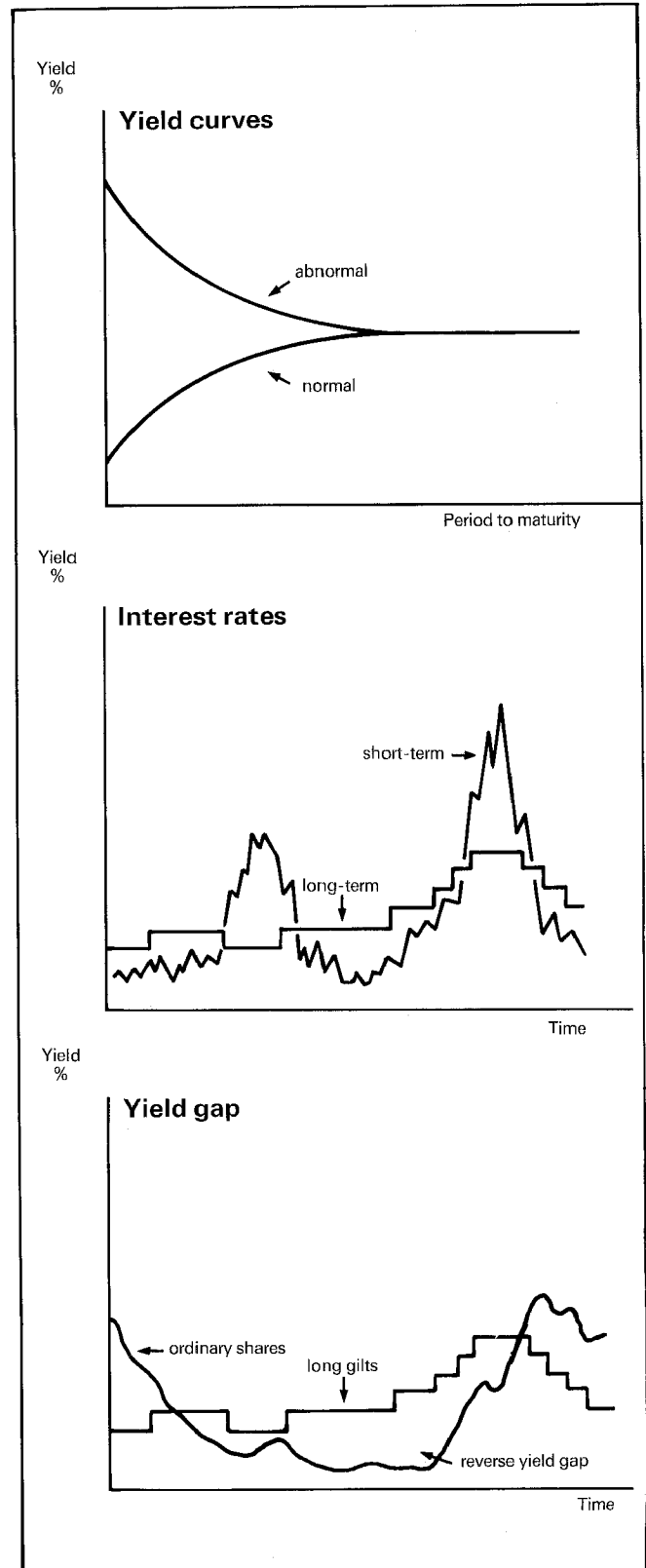
$$PV = \frac{d_1}{(1+i)} + \frac{d_2}{(1+i)^2} + \frac{d_3}{(1+i)^3} \dots \dots + \frac{d_n}{(1+i)^n}$$

Of course, in the real world d_1, d_2, etc. are not facts that are susceptible to objective calculation. They have to be estimated depending very much on what the individual analyst considers most likely having regard to his subjective view of the future performance of the company concerned. This, however, does not get away from the central importance of i in the methodology. Clearly, the greater i is, the less will PV be, and vice versa. All other things being equal, therefore, a rise in interest rates will reduce PV estimates while a fall in interest rates will make ordinary shares appear to be cheaper than they were before.

The present value approach is based on the simple understanding that, in a world of clearly definable interest rates, an amount of money due to be received at a future date is capable of being translated into current money terms. R100 if invested at the ruling rate of interest will accumulate to R110 in one year if the rate of interest is 10%, which is another way of saying that R110 in one year's time is worth R100 today.

It follows from what has just been said that interest rates are important to the valuation of ordinary shares because they represent the opportunity cost of equity investment. An investor contemplating buying an ordinary share listed on The Johannesburg Stock Exchange needs to know what he is giving up by not investing in a fixed interest repository that avoids the risk of income fluctuation or loss, if his decision is to be rational. Ceteris paribus, the risk of an ordinary share must be greater than the risk of a fixed interest security because an ordinary share represents the rights of an owner while the fixed interest security represents the entitlement of a creditor. Both in the case of payments of income and capital, the claim of a creditor is of higher rank in law than the claim of an owner and this is of the greatest importance in the valuation process.

It is the consideration of risk, of course, which determines the "normal" structure of investment returns. Thus, it is

Yield %

Yield curves

abnormal

normal

Period to maturity

Yield %

Interest rates

short-term

long-term

Time

Yield %

Yield gap

ordinary shares

long gilts

reverse yield gap

Time

usual to find long-term gilt edged securities offering lower yields than semi-gilts, and semi-gilts lower yields than industrial debentures of comparable maturity. The fact that running yields on ordinary shares (long-term securities in that they have no fixed date of redemption) may be lower than debenture yields is explained entirely by the possibilities of income growth that ordinary shares offer. In the absence of such growth and in a world where risk alone was the criterion of discrimination, the "normal" structure of investment returns would apply. A reverse yield gap (i.e. a gap reflecting a lower average flat yield on ordinary shares compared to the ruling average redemption yield on long-term gilts) should not, therefore, be regarded as "normal" as it can exist only because ordinary share investors are prepared to sacrifice some short-term income benefit for the benefit of a greater, albeit less certain, income later.

Strictly, the return on an ordinary share should not be measured by its ruling dividend yield, i.e. by the percentage of an historical annualised dividend payment to current market price. The true return on an ordinary share can only be measured by a comparison of all expected future dividends and market price, the return being that rate of interest or discount (see the equation given at the beginning of this article) which reduces the present value of expected future dividends to equality with the share's current market value. A return greater than the opportunity cost of the investment being considered would be encouraging to a purchase of the share, a return less than its opportunity cost would be the opposite.

But what rate of discount currently ruling should be regarded as the valid opportunity cost? This is a difficult question to answer and forces us into a comparison between short-term and long-term interest rates. Because short-term interest rates are normally lower than long-term interest rates, their use in the discounting process here described would result in more favourable estimates of ordinary share values than would the use of long-term interest rates. On the other hand, short-term interest rates sometimes exceed long-term interest rates and when they do, exercise a powerful attraction for the available cash resources of the community. Viewed from the view-point of society as a whole, ordinary shares undoubtedly are long-term securities and thus strictly should be evaluated in terms of ruling long-term interest rates. But for the individual investor, ordinary shares are not held in perpetuity. Indeed, they may be purchased with an intention to short period commitment and this makes short-term interest rates a factor of great importance in equity evaluation.

There are, thus, two dimensions to the type of change in interest rates that affect the valuation of ordinary shares. An upward or downward shift in the structure of interest rates has one effect, a change in short-term interest rates relative to long-term interest rates has another. Both of these are important and the dynamics of their inter-relationship has to be understood and applied in the process of investment evaluation.