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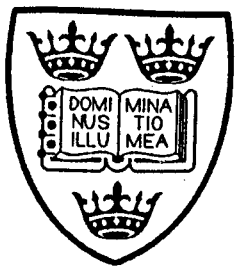

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THE RANDLORD'S BUBBLE 1894-6: SOUTH AFRICAN GOLD MINES AND STOCK MARKET MANIPULATION

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ABSTRACT

The early history of the Transvaal gold mines for long has been linked with imperialism, the Jameson Raid and the Boer War. The gold mine owners actually had no financial interest in war with the Boers since their money was made primarily by stock market manipulation, rather than in efficiently utilising the underlying assets. South African gold mining shares were consistently overvalued relative to their true earning power, both before and after the Jameson Raid. Only the outbreak of the war caused them to slump badly.

THE RANDLORD'S BUBBLE 1894-6: SOUTH AFRICAN GOLDMINES AND STOCK MARKET MANIPULATION

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> "More importantly still, this small group of men with a small number of confederates, representing the most highly organised form of international finance yet attained, controls the entire gold industry of the Transvaal. The names of the chief directors of the leading companies, Wernher, Beit, Eckstein, Rhodes, Rudd, Neumann, Rothschild, Albu, Goerz, Rouliot, Farrar, Barnato, Robinson, fairly indicates the distinctively international character of this financial power, as well as the concentrated form which it has taken."
>
> J. A. Hobson (1900)

The market for Transvaal mining shares was strongly inefficient at a time when the future of gold mining in the Transvaal was undergoing major restructuring. The mine owners, 'The Randlords', had sufficient influence and motive to accentuate or even promote this market inadequacy.[1] By contrast, much of the current literature argues that the Randlords had in general accepted the long term nature of gold-mining and were preoccupied with rationalising the industry, principally in order to keep the cost of mining low and therefore maintain or even increase its profitability for the foreseeable future. The literature is concerned primarily with the level of production, and in a second phase with the structure of ownership, but very little analysis of the stock market has been undertaken. No doubt because of the singular difficulty in obtaining relevant information, the actions of the Randlords in particular, have been given scant attention.

Section 1 provides a brief overview of the Transvaal gold mining industry at the end of the nineteenth century. Section 2 discusses the historiography. There is good reason to suppose that some form of market distortion was present between 1894 and 1896. In an efficient market, market capitalisation should reflect the market's expectations of the present value of discounted future dividends. Any permanent divergence of *ex post* present value dividend payments from *ex ante* market capitalisation, indicates the prevalence of asymmetric information in the market. These concepts will be discussed in Section 3. The following section, 4, calculates the nature and extent of market distortion. Quite why and how the market becomes distorted is a central issue of this study, and I propose that the

[1] The term "Randlords" originated in the British press to describe the mining magnates of the Witwatersrand gold fields. The quote by J.A. Hobson above lists most of the Randlords by name.

Randlords had both the incentive and the opportunity to exploit their own private information, as well as to supply disinformation to the general investing public. A good deal more research is needed to fully substantiate these claims, but indicators of how and why this may have occurred are discussed in Section 5.

1. The Emergence of the Transvaal Goldfields

Quite by whom and exactly when the Main Reef of the Witwatersrand was discovered is not known for certain, but the find was made some time in April 1886 on Portion D of the farm Langlaagte. This discovery, of gold in payable quantities, was to herald the start of a remarkable period in history which continues to the present day. Within the short period to the turn of the century, the Transvaal was transformed from a placid pastoral community into the world's largest gold producing area, production outstripping both the United States and Australia by 1898. In 1885, the Transvaal accounted for just 0.03% of the world's gold output; by the end of 1886 this had risen to 0.16%; but by 1898 the proportion had climbed to over one-quarter of the world's total production.

The nature of the gold discovery is in stark contrast to the discovery of diamonds in Kimberley over a decade earlier. In Kimberley, the "rush" for diamonds had seen thousands of speculators stake their claim on the Colesberg Kopje, toiling through harsh conditions to extract its wealth. This was possible because of the nature of the diamond pipes,[2] wherein the gems had lain for millions of years and through which the diggers shovelled and sifted in order to strike it rich. It would take men of the calibre of Cecil Rhodes and Barney Barnato a good portion of their lifetimes to rationalise the industry into the syndicated structure with which the diamond fields are now familiar. By contrast, the goldfields saw none of the "rush" and speculation that characterised the diamond fields and many of the other gold fields of the world, most notably in California and Western Australia. It was very soon apparent that the gold of the Transvaal was unlike that which had been encountered before. Extraction did not lend itself to speculators on a small scale but required capital on a massive scale.

Millions of years earlier, nature had deposited fine gold grains in a sediment upon the earth's surface, probably in a large lake or sea. The earth had been transformed many thousands of years later, and this saucer shape deposit had been plunged edge first deep into the earth's crust. The protruding edge had finally been exposed at the earth's surface and it was this outcrop which was discovered in 1886. The gold of the Witwatersrand was therefore neither in the

[2] Diamonds are loose and are easily found in the correct diamond-bearing ground. Diamond pipes, of the kind found in Kimberley, are zones of hard blue ground below loose, sandy soil. It was at first suspected that once the blue ground was struck, the diamonds had run out, but in fact this ground was pickable and easy to excavate, as well as being richer in stones as it was dug to greater depths.

form of gold nuggets which could be found or alluvial deposits which could be panned, but rather embedded as fine grains in hard rock, which would have to be crushed or milled before the gold could be extracted.[3] It was therefore obvious at the outset that gold mining would take on an entirely different character from that of the Kimberley diamond fields.

In addition, the self-made millionaires who had made vast fortunes on the diamond fields were able very quickly to supply capital to this new-found industry. The Gold Law of the Transvaal laid down that all mineral rights belonged to the State and that privately owned land could be proclaimed and thrown open, although the State did not have the right to throw open land without the permission of the owner. But of course the financial incentive to land owners to make their land available for mining far outstripped its agricultural worth. In addition to selecting six claims on the property, the owner received half the revenue from licenses paid by claimholders.[4] The Gold law also allowed the owner the right to mark off one-tenth of his land as a *mynpacht* or mining lease. This he could either mine himself; lease out; or sell. Of course the *mynpacht* could be and was staked along the outcrop, thereby increasing its initial value. In addition, areas were set aside by the claimholders for non-mining purposes, and were used for water reservoirs or tailing dumps. These were called *bewaarplaatsen*. These areas could be held for a sixth of the rent due on a mining claim. While this was attractive at first, these areas would soon provide a major source of friction when it was realised that the *bewaarplaatsen* to the south of the outcrop fell on valuable mining ground.

It did not take long for the developers of the mines to realise that the outcrop contained but a fraction of the wealth. Nature had one again been kind and it soon became apparent that the reefs were not only consistent with depth but that they tilted away to the south at flattening angle of dip at right angles to the strike of the outcrop.[5] It was possible to walk any distance south from the line of the outcrop, drill down, and eventually strike the reef. In addition, the outcrop was discovered to run east to west for a distance of approximately forty miles. But the reefs were not perfect. Many a speculator learned to his cost that a potentially promising group of claims might fall directly over a dyke or break in the reef, and prove worthless.

Capitalists took a while to gather their equipment, since the Witwatersrand is over 150 miles from the coast. Many months were necessary for the ox-wagons

[3] The Boers called this conglomerate in which the gold was present "banket", after a sweet-bread by the same name.

[4] A Transvaal Gold claim measured 150 by 400 Cape Feet, the shorter side along the strike or line of the reef.

[5] The Main Reef was the first to be discovered and exploited, but other parallel reefs were soon found (See Map 2).

to heave their goods up the escarpment to the Rand, at an altitude of over 6000 feet. But once the equipment arrived, the increase in gold output was dramatic. More and more stamps were commissioned and the amount of ore crushed increased on a monthly basis. In 1887 gold output was 23,155 fine ounces. By 1888 this had risen to 208,121; by 1892 the one million ounce mark was passed for the first time; and by 1894 output exceeded two million ounces per annum.

Table 1. Production between 1887 and 1899, in fine ounces

1887	23,155	1894	2,024,163
1888	208,121	1895	2,277,640
1889	369,557	1896	2,280,892
1890	494,817	1897	3,034,678
1891	729,268	1898	4,295,608
1892	1,210,868	1899	4,233,296
1893	1,478,477		

Source: Transvaal Chamber of Mines *Annual Reports*

Table 2. Relative working costs of the Transvaal mines in 1902

White labour	31.22%
Native labour	29.83%
Explosives	9.70%
Coal	9.07%
Chemicals (cyanide)	3.22%
Tools, etc.	3.29%
Mining timbers	4.05%
Candles, lighting	1.38%
Sundries	8.24%

Source: *The Mineral Industry: Its Statistics, Technology and Trade*, 1902

The extraction of gold employed a good deal of labour as well as capital, as the relative working costs in Table 2 show. In the first few years of the goldfield, mining was relatively simple. Ore could be picked from the outcrop, from whence it was taken to be crushed in stamp batteries. The pulverised ore was then mixed with water to produce sand and slime to be passed over copper plates coated with mercury. The slimes were tailed away to slime dams, while the particles of gold in the sands formed an amalgam with the mercury which was scraped off the plates. The gold was then refined and the mercury reused. By this process, the average recovery of gold from the ore in 1889 was about 64%, the balance running away into the slime dams. Many of the early homes were plastered with sand from the tailings, and were therefore quite literally plastered with gold. In the early stages of the goldfields, the ore was also of a relatively high grade.

But soon it was not possible to pick at the surface and shafts had to be sunk to get to the gold bearing ore at greater depths. The use of drilling and dynamiting became prevalent to remove the ore. In 1889 the gold industry suffered the first of many shocks when it was discovered that at depth the ore became pyritic, that is, sulphuric and non-oxygenated, and that the amalgam process was not successful in freeing the gold from this ore. The stock market crashed and by March 1890 the total market value of shares had fallen by 60%. In 1889 there were 25,000 white persons living in Johannesburg; by 1890 over one-third of this number had left. But as with many of the crisis to befall the Witwatersrand, a solution was not very far away. Two medical practitioners, Dr Robert and Dr William Forrest, joined forces with a self-taught chemist, John Stewart MacArthur, at about the time of the gold discoveries, in search of a cheap and efficient method of recovering gold from ore. Using the MacArthur-Forrest process, the crushed ore was dissolved in a solution of cyanide of potassium, the gold then precipitated on to zinc shavings from which it was recovered and refined. In 1891, 4.7% of the gold won was by this process; in 1892, 13.5%; and by 1893, 15.6%. With this process, the industry was thus able to work with lower grades of ore in order to maintain the profitability of mining on the Rand.

By the early 1890s deeper level mining had gained importance. The reefs were recognised to extend far away to the south. Digging deep would provide access to them, but the problem was threefold. Greater depth implied not only greater cost, but there were a limited number of reefs which provided a very low grade of ore.[6] The decisive factor was cost. The price of gold was fixed at 77s 6d for a "standard bar" of 22 carats.[7] Profitability could therefore only be obtained by careful attention to costs. In addition, a deep level mine would take some time to bring into production, as shafts were sunk to intercept the reef; a heavy financial burden had to be born before revenue was yielded. In 1892, with the Rand well on the way to recovery from its earlier setbacks, the jostling and positioning for deep level ground had already taken place in earnest. All of the ground immediately to the south of the outcrops was brought up, often in great secrecy in an attempt to keep the price of the land purchase down. In addition, land south of the profitable outcrops was most sought after, it being suspected for obvious reason that the availability of ore proven at the surface would continue at depth. One of the first great companies floated to develop these deep level mines was the Rand Mines Ltd, in 1893, with a capital of £400,000. It was turning point in the system of capital provision, and inaugurated a new style which has remained to the present day. In the first instance, it signalled the start of the "group system", whereby

6 The deeper the reef was stuck, the lower the grade of the ore became. In the Transvaal the average grade of ore was 6½ dwts; in Canada the average was 10 dwts and in Australia 12 dwts.

7 Per fine ounce, the price was set at 84s 11½d on the gold standard.

each mine was controlled by one of a few huge groups. Each mine was floated as a joint stock company with its own directors and its own manager, the Group maintaining control through share ownership and, more importantly, by dominating the board of directors. The individual companies were never wholly-owned subsidiaries, but rather the objective was to raise capital by flotation and the subsequent sale of vendors' interests, and in many cases to make substantial profit by the sale of shares, once stock prices had risen.

The second important consequence of the group system was the wave of amalgamation which began to take place. Older companies began to find that they were running out of ground to mine, while new companies, particularly the new deeper level ones, found that their funds were insufficient to bring their properties into production, since capital costs were enormously increased by the demands of deeper mining. Amalgamation proved to be a solution, particularly when facilitated by powerful financial groups. This system also afforded the investor the opportunity to spread his risk by investing in the shares of a group, which had a great portfolio of mines, rather than speculate in individual companies himself.

Vendors' interest was very often represented by the sale of land, held by the owners of the group, to the floated company, in return for shares therein. In many cases the providers of vendors' interest were able to make colossal profits by selling off their vendors' interest as stocks boomed (Kubicek 1979: 115-140).

By the end of 1894 the Transvaal mining industry was poised to embark on a programme of large scale deep level mining development. John Hays Hammond (1918:13), a leading engineer and later a conspirator in the Jameson Raid, described the Transvaal gold mines simply as "gold factories".[8] The extent of this development is shown by the number of company flotations which took place between 1892 and 1895, especially during 1895 (see also Richardson and Van Helten 1984:34).

But the cost of deep level mining was to prove a great burden, compounded by the Boer Government attitude to mining operation. Mine owners, in particular, were highly critical of the Government-granted monopoly on dynamite, not only because of its high cost but also its inferior quality; of the railway policy which meant that mining supplies attracted extortionate freight rates over the fifty mile journey within the Transvaal; and of the Government's unwillingness to assist in controlling the supply of labour through legislation.[9] These grievances will be discussed more fully in section 4, but it is worth noting at this stage that many of the economic interpretations which will be reviewed later focus on the Randlords'

8 Hammond, John Hays. *The Truth About the Jameson Raid.* Boston: Marshall Jones Company, 1918, p.13

9 The Transvaal Chamber of Mines *Annual Reports.* Also Hammond, John Hays. *The Truth About the Jameson Raid.* Boston: Marshall Jones Company, 1918, p.18-22.

understandable desire to lower the cost of mining in order to make it more profitable.

Table 3. Numbers of Gold Mining Companies floated before 1896, and which paid a dividend up to 1914:

1886	6	1891	2
1887	18	1892	4
1888	10	1893	7
1889	8	1894	5
1890	1	1895	16

Source: Goldmann, S. C. *South African Mines: Their Position, Results and Developments: Rand Mining Companies.* Vol. I. : 1895-96b.

However, it is the main contention of this paper that the Randlords and their associates used the stock market as the prime vehicle to amass vast fortunes, fortunes in excess of those that could be made simply through the extraction of gold, and that they influenced the market by the selective release of information. The Randlords were not much interested in developing the mines during this period. They were preoccupied primarily in making money from speculative activity on the London and Johannesburg stock markets. They used their privileged access to information, and exploited their ability to present misleading information to the public, in order to take advantage of the rise and fall in stock prices.

The paper shows that of those companies which were listed on the stock-exchange and which paid a dividend over a twenty year period, only a small proportion were in consequence valued on the market according to market fundamentals. This comparative exercise is conducted at various dates along the stock price cycle, beginning in December 1894 and ending in October 1896, about a year after share prices peaked in 1895. During 1895, historiography contends that dissatisfaction with the Boer Government led a group of Randlords to attempt an uprising in Johannesburg. The date for this 'Uitlander' uprising was provisionally fixed for 28 December 1895.[10] Jameson, a confidant of Cecil Rhodes, gathered his troops in late December in anticipation of this date. His abortive exercise was finally halted in Krugersdorp, twenty miles from Johannesburg, on 2 January 1896. Since stock prices fell substantially immediately after the Raid, it provides a convenient point at which to make comparison with the high of three months earlier. The results of these comparisons clearly show that mining companies were overvalued with respect to their future earnings, even when discounted at rates well below accepted capitalisation rates. Section 3 will review current theory of asset valuation and

[10] 'Uitlander' is Afrikaans for 'foreigner'.

dividend policy. It will also review the theoretical framework related to the analysing of bubbles and excess volatility in stock markets. But first we turn to the historiography of Transvaal gold.

2. Historiography of the Transvaal Gold Mines 1887-1900

In general, historians have classified the events of late nineteenth century and early twentieth century Transvaal into two broad categories; the political and the economic. In particular, two main events stand out in importance; the first being the Jameson Raid in 1895, and the second the Boer War, from 1899 to 1902. The banner under which there categories and events fall is invariably labelled "imperialism".

In fact, of the articles review, those which adopt an economic interpretation inevitably cite J.A. Hobson's *The Evolution of Modern Capitalism* (1906, 1928) or *Imperialism: A Study* (1938) within the first few paragraphs, while those who favour a political interpretation cite J.S. Marais' *The Fall of the KrugerRepublic* (1961). Both authors embrace imperialist explanations, but from opposing ends of the spectrum. Hobson argued that the Boer War had been instigated by the Randlords and their financial colleagues, in their desire to increase their profit from mining on the Rand. He also proposed that financially-based rivalry between conflicting groups of magnates was a key to political divisions. Marais, by contrast, examines the relationships between the British Government and the South African Republic, and focuses on the disputes between these two parties in the period between the Jameson Raid and the War in particular. For a long period of time the political interpretation was in the greatest favour.

In the 1960's, a shift took place in favour of a Hobson-type economic interpretation, particularly when Geoffrey Blainey proposed a return to the economic evaluation.[11] Blainey returned to the idea of conflict between the Randlords by suggesting that those Randlords who had greatest interest in deep level mining were also those most implicated in the Jameson Raid. Blainey maintains that "...This distinction between outcrop and deep mines seems vital for understanding the motives of the Rand capitalists ...".[12] He then proceeds to explain why the Randlords with a large stake in deep level mining should be sufficiently aggrieved to mount an armed uprising against the Boer Government. Since his argument forms the cornerstone of subsequent economic interpretations, it is as well to outline his theory.

At the start of mining operations, the outcrop companies were able to work the reef close to the surface, with very little effort and expenditure needed to reach the gold-bearing ore. By contrast, the deep levels required a much larger initial

[11] Blainey, G. "Lost Causes of the Jameson Raid." *Economic History Review* 18 (1965) : 350-66.

[12] Ibid. p.354

investment and years of costly shaft sinking before realising a return. In 1895 the deep levels were in this risky shaft sinking phase, while the outcrops continued to operate profitably. To add to these difficulties, certain State policies (or the lack of them), threatened the already vulnerable deep levels while not seriously affecting the outcrop mines. The first was the dynamite monopoly, granted by the Government, which affected the deep levels more than the outcrops, firstly because of the greater volume of rock which had to be blasted in shaft-sinking, and secondly because the rock was harder at depth and therefore required more explosive. The second was the scarcity and high cost of labour. While this obviously affected all mining companies, Blainey contends that it affected the deep levels to a greater extent because of their need to maintain a high level of production to cover their considerable overhead costs. The third was the cost of fuel, in particular coal, which was made expensive by the extortionate freight rates charged by Kruger's government. This affected the deep levels to a greater extent because they needed to haul up men and ore from greater depths.

In addition, the gold law discriminated against deep levels in the form of taxation. The outcrops, many of which held *mynpachten*, paid a nominal rental for this ground, while most of the deep levels, which did not hold mining leases, did not enjoy this benefit.

A further complaint was against the *bewaarplaatsen*, which generally fell on land which intruded onto the deep levels. The government's reluctance to hand over these portions of land to the deep level companies threatened them because of their fear that the government might hand them over to persons who could hold the deep level companies to ransom.

Finally, the fall in the stock market affected the deep levels by firstly limiting the opportunity to make profits from share dealings, upon which many of the deep levels were dependent for income, and secondly by limiting the potential for raising the much needed capital so necessary for the deep level programme.

He concludes by saying "...The Jameson Raid, I suggest, was essentially the revolt of the two big companies that were heirs to the treasures and problems of the deep-levels."[13]

Robert Kubicek, while acknowledging the distinction between outcrop mines and deep level *at the level of production*, nevertheless disputed it on the grounds of the *structure of ownership*.[14] He maintained that:

> "The financial vulnerability of these groups was not, as has recently been asserted [by Blainey], predicted exclusively upon whether or not they were engaged in deep-level developments. Nor can their financial position be determined, as it often has been, by studying the complaints of Randlords about restrictive and inefficient practices of the Transvaal government. How soundly the mine owners developed claims, build capital structures and took profits must be taken into account....In other words no commonly shared financial problem distinguished the Randlords who participated in subversive politics from those who did not."[15]

Robert Mawby also emphasised the ownership profile but went further then Kubicek in criticising the Blainey distinction:

> "The theory's greatest weakness, however, is that implication that the only significant variable in mining economics was the cost of operations".[16]

He goes on to say that:

> "...the distinction between outcrop and deep-level mining houses is untenable. Eckstein's [Rand Mines Ltd] and Consolidated Gold Fields were simply the *first* mining houses to move into deep-level mining. As it became obvious during the later 1890's that the future of gold mining lay in deep-levels, so most mining groups acquired deep-level holdings."[17]

Richard Mendelsohn, while acknowledging the Blainey theory in terms of renewed search for an economic interpretation for the actions of the Randlords, follows the Kubicek and Mawby rebuttal. He states:

> "While Blainey's extended argument that the economic necessity drove the Rand's deep-level companies to rebellion in 1895 has effectively been dismantled, his basic technique of exploring the contrasting economic interests of the firms that joined the conspiracy and those that did not, might still provide the best means of uncovering the 'lost causes' of the Raid."[18]

He closes his paper by saying, "... Perhaps the Jameson raid was not the last throw of the despairing but, instead, a bold bid by the audacious."[19]

While much of the literature discusses the Raid as a central issue, mainly because much of it is a rebuttal of the Blainey theory, it nevertheless provides some indication of the position of the contemporary economic interpretation. As previously indicated, much of the discussion focuses on the productive capacity of

[13] Ibid. p.364. The two big companies were Goldfields, controlled by Rhodes and Rudd, and Rand Mines Ltd., controlled by Wernher, Beit and Co.

[14] Kubicek, R. V. "The Randlords in 1895: A Reassessment". *Journal of British Studies* 11 (1972): 84-103.

[15] Ibid. p.102.

[16] Mawby, A. A. "Capital, Government and Politics in the Transvaal, 1900-1907: A Revision and a Reversion." *The Historical Journal* 17 (1974): p.389.

[17] Ibid. p.392.

[18] Mendelsohn, Richard. "Blainey and the Jameson Raid : The Debate Renewed." *Journal of Southern African Studies* 6 (1980) : p.167.

[19] Ibid. p.170.

the gold fields and on the belief that the Randlords were committed to long-term mining programmes. It does therefore seem strange that a large group like Wernher, Beit and Co. were, according to Kubicek, not totally committed to this belief. He says, in a passage quoting Julius Wernher, a senior partner in Wernher, Beit and Co. and in the Corner House:

> "From the vantage point of London, the Transvaal, where 'politics unfortunately seem to sway everything,' was too much of a risk. Early in 1896 in the aftermath of the Jameson raid, Wernher, the Corner House's chief financial architect, said to Georges Rouliot, a partner in Eckstein's, 'we want to get out rather than in.' 'Of course,' he continued, 'it requires time and much discretion and no doubt we will do yet a good many transactions before we accomplish our objective. We don't want to go out of business but do it with reduced capital - later on in the form of a company with reduced cares, risks and liabilities.' Wernher expected that 'with improved output and returns' from the mines, and a 'more active' stock market, the firm 'should succeed in reducing nearly as much as we like in two years."[20]

In fact Kubicek, in this same work, all but ignores any reference to the level of production as a major consideration in the motives of the Randlords, instead focusing rather at the level of ownership to explain differences between the various groups; emphasising such factors as the nationality of the major partners, their varying sources of capital and their different financial strategies with regard to short and long-term development.

He does in places allude to the speculative nature of the industry, but in specific rather than general instances. For example, in a study of the activities of the Goldfields' Group, in which Cecil Rhodes had a very direct interest, he notes:

> "Goldfields' deep level assets were put into a wholly owned subsidiary, Gold Fields Deep, formed in 1893. Since deep-level had not yet been realised, it might be assumed that the subsidiary was formed to shelter the parent firm from the worst effects of failure. But the subsidiary was also a convenient device through which to inflate Goldfield's vendor interest in deep-levels. Speculation, as well as developments, continued to dominate the financial strategies of Goldfields' London directors."[21]

In a chapter titled "The Houses of Ill Repute", Kubicek examines the speculative activities of the less 'reputable' groups, adding weight to the view that speculative activities, as well as development programmes, were an important source of prosperity. Kubicek refrains from classifying the Corner House as

[20] Kubicek, Robert V. *Economic Imperialism in Theory and practice : The Case of the South African Gold Mining Finance 1886-1914.* Durham, N.C.: Duke University Press, 1979, p.70.

[21] Ibid. p.98.

speculative, whether through lack of evidence or desire, but there is no doubt scope for such an investigation. The results obtained in this study at least suggest that such an investigation is warranted, and that no group should be assumed to be free from a speculative motive.

The literature may therefore be classified into two main themes; the relevance of the level of production and the relevance of the structure of ownership. It is of course difficult to entirely separate the one from the other, but it is the strength of argument in favour of either one which is distinguishable in the literature.

A final issue which is revealed in the literature is the Randlords' unrivalled control of the press. By selectively using the press they were able not only to exploit their private information, but more importantly to supply disinformation to the general public. There was little doubt that the press could be "bought" and that this provided the Randlords with a wonderful opportunity firstly to bolster their own image, and secondly to send misleading signals to the public at large. The frequent publishing of "profit" figures is an obvious example. As Kubicek says "...One tactic it [the Corner House] employed to restore investor confidence was to ensure a favourable press."[22]

Geoffrey Wheatcroft comments:

> "The rand financiers could buy the South African press and they doubtless bought the Paris press when it suited them. The London press was less biddable."[23]

However, "less biddable" does imply some measure of leniency and this was no doubt exploited. The use of the press as a vehicle to mislead and direct the public at large seems to be more than probable.

3. Valuing Market Stocks

Stock market investors expect to derive cash dividends and capital gains. The precise return they expect is determined by rates of return of investments in a similar 'risk class'. This rate is defined as the sum of the expected dividend for the next year (DV_1) plus the expected appreciation in price ($P_1 - P_0$) of the stock, divided by the price of the stock in the current period (P_O). This rate of return is often called the market capitalisation rate, and may be written as :

$$r = \frac{DV_1 + P_1 - P_0}{P_0} \qquad (1)$$

If, for example, the price of a share one year from now were known as well as the expected dividend over the next year, then it would be possible to predict the price of the share today by application of the present value formula, where:

[22] Ibid. p.82

[23] Wheatcroft, Geoffrey. *The Randlords.* London:Weidenfeld and Nicolson, 1985. p.134.

$$P_0 = \frac{DV_1 + P_1}{1+r} \quad (2)$$

Similarly, the price of the stock in the second year should be:

$$P_1 = \frac{DV_2 + P_2}{1+r} \quad (3)$$

Combining equations 2 and 3 we obtain:

$$P_0 = \frac{1}{1+r} \times (DV_1 + P_1) \quad (4)$$

$$P_0 = \frac{1}{1+r} \times \left(DV_1 + \frac{DV_2 + P_2}{1+r} \right) \quad (5)$$

$$P_0 = \frac{DV_1}{1+r} + \frac{DV_2 + P_2}{(1+r)^2} \quad (6)$$

From equation 6 it is clear that it is not necessary to forecast the price of the stock in year 1 but only in year 2. Following this logic through, we may expand the formula so that the value of the stock in the current period may be determined by adding the present values of a stream of future dividends to the present value of the forecasted dividends to the present value of the forecasted stock price at some horizon period. This formula may be written as:

$$P_0 = \sum_{t=1}^{H} \frac{DV_t}{(1+r)^t} + \frac{P_H}{(1+r)^H} \quad (7)$$

As the horizon period (H) approaches infinity, the present value of the forecasted stock price ought to approach zero, so that we can express the price today entirely as the sum of discounted future dividends

$$P_0 = \sum_{t=1}^{\infty} \frac{DV_t}{(1+r)^t} \quad (8)$$

At any point in time, the share price multiplied by the value of paid up capital gives us the market capitalisation of that investment. In an efficient market (see section below), we would expect the present value of the investment, given by the value of discounted future earnings, to equal the market capitalisation. If the market capitalisation is greater than the present value, then such an investment may be said to be overvalued on the stock market. Conversely, if the market

capitalisation is less than the present value, then such an investment may be said to be undervalued. Simply stated, the sum of discounted future earnings should, in an efficient market, be equal to the product of share price and paid up capital, or:

$$\sum_{t=1}^{\infty} \frac{FE_t}{(1+r)^t} = P_0 \times CP_0 \quad (9)$$

Stated another way, the present value of future earnings (PV) should be equal to the *market fundamental value* (PV^f). We may write the equation thus:

$$PV = PV^f + e \quad (10)$$

The error term e represents the deviation of the current market price of the asset from the value implied by market fundamentals. If the market were efficient, then we would expect e to be equal to zero.

The Efficient Market Hypothesis

A market for stocks may be said to be efficient if it fully and correctly reflects all relevant information in determining the price of these stocks. In other words, if by revealing some set of information to all investors, the price of the stock remains unchanged, the market may be said to be efficient. Three levels of market efficiency are commonly defined. The *weak* form of the efficient market hypothesis asserts that prices reflect all information contained in the record of past prices. For example, charting, the method of 'eyeballing' historical data in the search for trends, will not provide a path to abnormal profits, the market having absorbed and incorporated such historical information in prices already.

The *semi-strong* form of efficiency is the case in which prices reflect not only past prices but also all publicly available information relating to the asset's price. For example, information such as the company's balance sheet and income statements, announcements of dividends, merger possibilities and so on, is rapidly and accurately incorporated in the price of the stock.

The final version of the efficient market hypothesis is the strong form in which not only public information, but all information that is known to any market participant, is fully reflected in market prices. Therefore not even those with privileged information can make use of it to yield abnormal profits.

It is important to realise that market efficiency implies simply that prices reflect all available information and *not* that the market can be perfectly forecast. It is because the future is so uncertain that prices fluctuate. Changes in prices can therefore only occur because of unpredictable news becoming available to the market; price changes are therefore themselves unpredictable. Price changes in an efficient market are therefore random, because if prices always reflect all relevant

information, then they will only change when new information arrives. But this new information cannot be predicted ahead of time, or it would not be new information, and therefore prices *cannot* be predicted ahead of time. In other words, if stock prices reflect all that is predictable, then stock price *changes* must reflect all that is unpredictable.

Excess Volatility and Bubbles

The hypothesis that the current price of a stock is equal to the discounted sum of expected future dividends is an alternative formulation for the efficient markets hypothesis. The finding that market prices vary by more than this sum is often called excess volatility; and implies that prices are predictable rather than unpredictable as would be anticipated if the market were efficient. Shiller (1981) in particular disputed the theory of efficient markets. He argued that stock prices, as revealed by Standard and Poor's Composite Stock Price Index, were far more volatile than expectations concerning the associated dividend series warranted.

Stiglitz (1990 : 13) has pointed out that :

> "If asset prices do not reflect fundamentals well, and if these skewed asset prices have an important effect on resource allocations, then market allocations of investment resources may be inefficient."[24]

The debate surrounding the efficient market model and excess volatility and bubbles continues. Both groups find evidence which support their hypotheses. It is on statistical issues, and the validity of statistical tests, that opinions divide.

Stiglitz (1990:13) gives a succinct definition of the term 'bubble':

> "If the reason that the price is high today is *only* because investors believe that the selling price will be high tomorrow - when 'fundamental' factors do not seem to justify such a price - then a bubble exists."[25]

Typically the research problem is to distinguish bubble movements in stock prices from the possibility that the underlying fundamental model is misspecified. Flood and Hodrick (1994) conclude that no previous study solved this problem.

The approach adopted in this paper is firstly to accept the efficient market hypothesis, and to calculate the discounted future dividends (actual dividends paid from the point of comparison to 1914) as the *ex post* efficient market valuations. This figure is then compared with the *ex ante* actual valuation given by the market capitalisation at a comparison date. Secondly, it is assumed that any violation of the efficient market hypothesis, that is, where the fundamental value differs from the market value, is indicative of market inefficiency rather than a misspecified model. Thirdly, the paper provides possible explanations for this volatility and how the market may have been inefficient.

[24] Stiglitz, Jospeh E. "Syposium on Bubbles." *Journal of Economic Perspectives* 4 (1990): p.13.

[25] Ibid. p.13

Dividends or Earnings

A key concept in this study is future earnings. In accounting terms, the earnings of an enterprise may be defined as the difference between gross revenue and working expenses associated with generating this revenue. These earnings represent the amount which is available for distribution to holders of shares and/or the amount available for reinvestment in the enterprise. Total earnings are thus equal to cash dividends plus retained earnings. Apparently then unless retained earnings are equal to zero, the use of cash dividends alone as a measure of future earnings may be unreliable.

On these grounds it is often argued that the efficient market model (Equation 12) should be replaced by a model which makes the price equal to the present value of total earnings rather than dividends. There are, however, two practical reasons why profit figures would be inappropriate. The first is that accounting procedures were not well regulated during this period and it was therefore possible to generate financial statements which excluded certain expenditure and therefore overinflated the profit margin. George Denny, a prominent writer on the gold-mining industry, commented as follows in 1907:

> "Having so many different systems of accounts, and so many methods of arriving at 'profits', even the most careful scrutiny fails to discover the comparative values of the 'profits' declared by the different companies."[26]

The second reason is, that apart from poor accounting practice, the incentive to overinflate profits was not tempered by a stringent rate of taxation. For the period under examination, taxation was set at a nominal five per cent, and was hardly a disincentive to declare large and overstated profits.

Apart from these two specific reasons, however, there is a more general reason why the use of profit or earnings figures would be incorrect. The efficient market model, as defined in equation 8, is consistent with the idea that investors are concerned with returns, that is cash dividends and capital gains. The efficient market model therefore implies that expected total returns are constant and that the capital gains component of returns is simply evidence of incorporation of information about future dividends. There is therefore no reason why the value of a stock should be the present value of expected earnings if some earnings are retained. Once we know the terminal price and the intervening dividends (or have an infinite stream of dividends), we have specified all that investors are interested in. For these reasons, dividends payments between the periods of comparison and 1914, and not well publicised profit figures, have been used.

The Horizon Value or an Infinite Stream of Dividends?

In calculating the *ex post* value, a decision had to be taken whether to include an infinite stream of dividends or provide a set of intervening dividends prior to some

[26] Denny, George A. "The Commercial Aspect of Rand "Profits"'. p.3.

horizon value. Both computations were done; the first (DFE) with a dividend stream up to 1914, giving a discount period of 20 years, and the second with a horizon value set twenty years hence with an intervening stream of dividend payments (DFE2). The horizon value in DFE2 was assumed to be the par value of issued capital. The share price is not used at the end of the discount period for two reasons. The first is that in a persistently misled market it is likely that the price at the horizon value would also be biased and so bias the test. The second is that for practical reasons, the matching of share prices in 1895 and 1914 may not in all cases be possible, since some companies had at the terminal date ceased their useful life and been dissolved. It is important to note that the Transvaal mining companies were not valued in perpetuity (as is common in modern accounting practice), but were in fact investments with a limited life-span and were consequently valued according to their expected payable life.[27] For those companies which had dissolved, the terminal value would thus, in any event, be zero. For those still in existence, the discount period of twenty years ensures that at discount rates approaching fifteen per cent, the present value of the horizon tends to zero (see equations 7 and 8). For discount rates below ten per cent, the horizon value becomes more important, and it is for this reason that a horizon value was tested. A Kolmogorov-Smirnov Test was performed to establish the degree of agreement between cumulative distributions calculated to infinity against those constructed with a horizon value. The tests revealed that no significant difference existed between the two distributions and therefore the sum to infinity formula was used in constructing the Tables (Equation 8).

In acknowledging that many of the mines listed in the comparisons were not anticipated to last much beyond twenty years, and accepting that investors would expect not only some return from their investment in the mining company, but that they would also expect to recover their capital before or at the end of the valuable life of the mine, the inclusion of nominal value of the share at the horizon seems appropriate.[28] In addition, an evaluation of the overall trend in share prices up to a ten year horizon from 1895 indicates that prices were not rising uninterruptedly but were in fact stable and were very often at levels lower than the 1894 to 1896 period.[29]

[27] For example, *The Statist* (Vol 35) 1895, p.190-191. A worked example showing the calculation of the life of the Geldenhuis Mine is given on p.275.

[28] Mabson, R.R. *Mines of the Transvaal.* Fourth edn. London; *The Statist*, 1907, p.23-28 provides a useful account of how investors were likely to value their investment in mining concerns.

[29] For example, see *The Statist* (October 6, 1906), p.565-566.

Market Capitalisation Rate

The final important theoretical issue is the choice of discount rate. The lower the discount rate, the less important time is in lowering the value of money. A high discount rate by contrast implies that time is important and that money in the future will be worth a lot less than it is at the present time. Two important considerations need to be addressed in settling upon a discount rate applicable to the period under consideration. The first is, to what extent is inflation likely to erode the value of money over time?

Table 4 Price levels, 1890-1911

Average	*UK (Board of Trade)*	*UK (Sauerbeck)*	*France*	*Germany*
1890 - 1899	100	100	100	100
1900- 1909	111	111	115	118
1910	113	118	128	132
September 1911	-	122	139	-

Source : Hobson, J. A. *The Evolution of Modern Capitalism*, 1917, p.460.

In other words, accepting that a pound tomorrow may be able to buy less than a pound today, the question is, by how much will it be less? It seems reasonable to suppose that investors discounted future earnings to accommodate the declining value of money. Table 4 shows an index of price changes for the period 1890 to 1911. From these figures it is clear that some allowance for the declining value of money is appropriate.

The second issue is that investors wanted some rate of return on their investment and that, all other things being equal, they would balance risk against return and demand a rate of return on their investment at least similar to any other investment in a similar "risk class".

A third and often neglected issue is that because the mines were essentially a 'wasting' asset, investment in a mine with a short life ought to require the investor to allow for the recovery of his capital investment over an acceptable investment period. Frankel (1967) noted that the accounts of the gold mining companies make no provision for depreciation by accumulating reserves to maintain the capital invested to repay the capital when the enterprise closed.

Some indication of the expectation of investors of their rate of return is therefore required. George Denny wrote in 1907 of a Rand investment paying a dividend of £6,000,000 per annum:

"The probable average duration of the presently producing mines is, say fifteen years. A prudent investor will therefore calculate his return over a period which gives a fair margin of safety, say, twelve years. The proposition then

resolves itself into the computation of £6,000,000 per annum for twelve years, calculating *interest at 8 per cent, and redeeming capital at 3 per cent.*"[30]

Also in 1907, R.R. Mabson anticipated that an investor would want a return of between 5 to 10 percent on his money, while at the same time providing a sinking fund for the recovery of his capital at rates of between three and five per cent.[31]

The comparisons in the present valuation exercise are at capitalisation rates of five, ten and fifteen percent. A capitalisation rate of between ten and fifteen percent is implied by Mabson and Denny's evidence. It will be shown that, even at the low rate of discount of, say, five percent, a very significant proportion of the mining companies are grossly overvalued.

A final point to make is that the rate of capitalisation has been assumed to be constant over the period under consideration. It is argued that the efficient hypothesis model may be modified to include a variable discount rate, and while this is simple from a computation point of view, there are obvious problems associated with selecting appropriate values. Indeed the paper tests to see at what rate of discount the majority of stocks would be valued according to market fundamentals. This was found to be between one and two percent for 1894-6. It therefore seems unlikely that a fluctuating rate of discount would make a substantial difference to the results obtained in this study.

4. Estimating Market Fundamentals 1894 -6

In this section it is shown that over a period of two years, in which mining shares peaked and subsequently fell, the actual market valuation of dividend paying shares greatly exceeded the discounted value of future earnings which would be expected in an efficient market. The principal method of performing this evaluation has been to compare the market value of the relevant stocks at a particular point in time with their market fundamental value defined by the sum of discounted future earnings. Four dates of comparison were chosen, 8 December 1894, 28 September 1895, 4 January 1896 and 10 October 1896. The first date is approximately one year before the prices fell sharply after the failed Jameson Raid, and also at the start of the period in which deep level mining was being launched in earnest. The second date represents the approximate zenith of market prices in 1895. The third is of course shortly after the Jameson Raid and reflects a period of severe collapse in the market for gold-mining shares. In the middle of 1896, after a short rally, the market again paused for a small correction and remained depressed well into 1897 "principally by reason of reiterated and vehement assertions that deep-level mining on the Rand was not going to be as successful as

[30] Denny, George A. *The Commercial Aspect of Rand "Profits"*. p.2

[31] Mabson, R. R. *Mines of the Transvaal*. Fourth ed. London; *The Statist*, 1907, p.23-28.

previously it had been expected would be the case."[32] October 10, 1896 therefore provides a convenient point at which to make comparison after this short recovery. The purpose of choosing these dates from a theoretical point of view is that they represent periods when the market for shares was moving from a bull market to a bear market or vice versa. This allows us to compare the market value with the fundamental value at both a peak and a trough, as well as the two periods on either side of these important shifts, all within the space of two years. This is to ensure that a cyclical bias is avoided and to demonstrate that the overvaluing of stocks against fundamentals was persistent throughout the period under examination, regardless of the stock market trend.

To determine the fundamental market value, dividends for those companies which paid a dividend between 1887 and 1914 are tabulated. 1914 is assumed to be a suitable point until which to list dividends because it both coincides with the start of the First World War and provides a long enough period of discounting for the later years to approach "infinity" as earlier defined. It also represents to a large extent the expected horizon date for a great majority of the companies, as indicated by the mining market in 1895. As the comparison tables reveal, the majority of companies which are compared are outcrop mines and it would therefore be expected that the life of these mines would not exceed a 20 year probable life.[33] Some listed companies failed to pay a dividend at all up to 1914, and their dividend neglect is noted in the Distribution Table 6.[34]

[32] Mabson, R. R. *Mines of the Transvaal*, Fourth ed. London; *The Statist*, 1907, p.11

[33] *The Statist*, Vol. 35, p.191, p.375. Of the 22 mines listed in these tables, the distribution of the probable life of the mines is as follows:

0 - 10 yrs	2 mines
11 - 20 yrs	12 mines
21 - 25 yrs	3 mines
26 - 30 yrs	2 mines
30+ yrs	3 mines

[34] Since companies are compared according to their percentage under or over valuation, any company which does not pay a dividend within the 20 year period is infinitely overvalued (dividing by zero is infinity). They are added to the distribution tables.

Table 5. Gold mining companies in December 1894

*	December 8, 1894	Rgn	Depth	Life
5%	Market Capitalisation Rate			Feb 1896
54	Langlaagte Royal	W	1	
67	New Croesus	W		
79	Paarl Pretoria (Central)	W		20
2	Aurora	W	0	
43	Johannesburg Pioneer	W	0	
7	Bonanza	W	1	
35	Ginsberg	W	0	12
106	Village Main Reef	W	1	
57	May Consolidated	W	0	14
109	Wemmer	W	0	8
28	Ferreira	W	0	
103	Van Ryn	W	0	
25	East Rand Prop. Mines	W		
19	Crown Reef	W	0	
86	Robinson	W	0	17
44	Jubilee	W	0	
58	Meyer and Charlton	W	0	13
113	Witwatersrand (Knight's)	W	0	66
69	New Heriot	W	0	19
13	City and Suburban	W	0	15
72	New Primrose	W	0	16
22	Durban Roodepoort	W	0	25
95	Simmer and Jack	W	1	30
116	Worcester Exploration	W	0	
33	Geldenhuis Estate	W	0	10
41	Henry Nourse	W	0	24
97	Stanhope	W	0	
115	Wolhuter	W	1	30
90	Roodepoort United	W		18
53	Langlaagte Estate	W	0	
32	Geldenhuis Deep	W	1	
73	New Rietfontein	W	0	
45	Jumpers	W	0	13
15	Consolidated Deep Levels	W	1	
75	Nigel	D	-	35
82	Princess Estate	W	0	20
37	Glencairn	W	0	12
94	Sheba	D	-	
93	Salisbury	W	0	
77	Nourse Mines	W	1	
6	Block "B" Langlaagte	W		
78	Orion	W	0	
18	Crown Deep	W	1	
11	Champ d'Or	W		
60	Modderfontein B	W		
64	New Chimes	W	0	
55	Luipaards Vlei Estate	W		
99	Transvaal Gold Exp. & Land Co.	D	-	
4	Barrett	D	-	
102	United Ivy	D	-	
34	Geldenhuis Main Reef	W	0	10
55	New Clewer Estate	D	-	
			Mean	20.3
			Stdev	12.7
			CV	62.60%
			N	21

Share Price	Nom Val	Paid-up Capital	Market Capitalisation	DFE 0	Diff £	Pct Diff
4.2500	1	150,000	637,500	0	637,500	?
1.6875	1	225,000	379,688	0	379,688	?
1.1580	1	138,750	160,673	0	160,673	?
0.7750	1	65,000	50,375	0	50,375	?
3.8750	1	21,000	81,375	349,804	(268,429)	-77%
1.0625	1	200,000	212,500	934,271	(721,771)	-77%
0.7750	1	130,000	100,750	369,445	(268,696)	-73%
4.3125	1	177,000	763,313	1,843,350	(1,080,037)	-59%
1.5330	1	236,000	361,788	882,490	(520,702)	-59%
5.3125	1	55,000	292,188	647,324	(355,136)	-55%
13.2500	1	89,000	1,179,250	2,432,087	(1,252,837)	-52%
3.6875	1	105,000	387,188	764,096	(376,908)	-49%
1.6880	1	650,000	1,097,200	2,077,382	(980,182)	-47%
9.1250	1	120,000	1,095,000	1,785,330	(690,330)	-39%
7.3438	5	2,750,000	4,039,063	5,882,351	(1,843,288)	-31%
7.0000	1	30,000	210,000	299,256	(89,256)	-30%
6.5625	1	83,157	545,718	725,738	(180,020)	-25%
2.4375	1	250,000	609,375	772,586	(163,211)	-21%
7.7500	1	85,000	658,750	791,280	(132,530)	-17%
15.7500	1	85,000	1,338,750	1,614,237	(275,487)	-17%
5.1875	1	277,902	1,441,617	1,543,115	(101,498)	-7%
6.3750	1	125,000	796,875	837,682	(40,807)	-5%
10.3750	1	250,000	2,593,750	2,629,056	(35,306)	-1%
3.0625	1	90,727	277,851	274,382	3,469	1%
5.5000	1	200,000	1,100,000	1,073,684	26,316	2%
4.6875	1	125,000	585,938	551,549	34,389	6%
1.9375	1	34,000	65,875	58,361	7,514	13%
3.7500	1	130,000	487,500	411,491	76,009	18%
3.9375	1	130,000	511,875	428,680	83,195	19%
4.1250	1	470,000	1,938,750	1,564,312	374,438	24%
6.0625	1	265,000	1,606,563	1,263,017	343,546	27%
3.0625	1	160,000	490,000	383,554	106,446	28%
5.4375	1	100,000	543,750	382,359	161,391	42%
2.3750	1	187,250	444,719	263,746	180,973	69%
4.5000	1	160,000	720,000	421,132	298,868	71%
1.3750	1	140,000	192,500	96,874	95,626	99%
3.0625	1	225,000	689,063	338,932	350,131	103%
1.4500	1	847,500	1,228,875	572,433	656,442	115%
3.1250	1	70,500	220,313	91,896	128,417	140%
5.0000	1	375,000	1,875,000	765,410	1,109,590	145%
0.5000	1	606,174	303,087	122,270	180,817	148%
5.1250	1	30,000	153,750	61,976	91,774	148%
11.5000	1	250,000	2,875,000	1,149,166	1,725,834	150%
3.3750	1	128,854	434,882	139,754	295,128	211%
6.3750	1	175,000	1,115,625	327,932	787,693	240%
2.6875	1	100,000	268,750	71,916	196,834	274%
0.6500	1	350,000	227,500	29,704	197,796	666%
3.1875	1	260,000	828,750	93,695	735,055	785%
0.3380	0.5	103,748	70,134	6,977	63,157	905%
0.9380	1	45,000	42,210	3,143	39,067	1243%
3.9688	1	150,000	595,320	41,529	553,791	1334%
1.8750	1	100,000	187,500	5,000	182,500	3650%
		236,665	752,188	734,149	18,039	191.06%
		389,411	779,529	987,621	567,845	577.34%
		164.54%	103.63%	134.53%	3147.93%	302.18%
		52	52	52	52	52

Description of Comparison Tables

Table 5 gives a specimen company comparison for December 8, 1894 at 5% market capitalisation. Column 1 is a reference number, in order to provide easy reference when the companies are sorted. There are 117 companies listed in the master table (not shown), these being the companies belonging to the Transvaal Chamber of Mines and which paid a dividend between 1887 and 1914.[35] In April 1896 twenty-two companies seceded from the Chamber of Mines to form a rival Association of Mines led by Robinson, Albu and Goerz. This followed on from the failed Raid and was the measure by which those mine-owners who had stood outside the plot marked their displeasure in a practical way. However, this split was short-lived, and by April of the following year the Chamber and the Association were once again reunited. Column 2 lists the companies by name. Where companies changed name or were amalgamated before 1914, the dividends relating to the dissolved company have been incorporated in the new company by the Chamber of Mines. Column 3 details whether the company forms part of the Witwatersrand (W) or if it belongs to one of the outlying districts (D).[36] This is to evaluate on a simple basis whether the companies outside the main Witwatersrand area were prominent as dividend payers or not, and whether they were more speculative than their Witwatersrand counterparts. All the companies outside the Witwatersrand were overvalued according to the model presented.

Column 4 details whether the company is classified as a deep-level concern (1) or as an outcrop concern (0). Again it is desirable to test, especially in view of the literature discussed in section 2, whether the deep level companies were more speculative then the outcrop mines. However, no distinctive distribution pattern could be detected. Column 5 lists, where possible, the probable life of the mining company, as projected in February 1896.[37] Column 6 is the price of the company share at the date of the comparison and is given in pounds sterling. These figures have been converted from the original list prices given in pounds, shillings and pence. Column 7 lists the par value of the issued capital in pounds sterling. Column 8 lists the paid-up capital of the company at the date of comparison. In many cases not all the issued capital had been full paid up and therefore in calculating market capitalisation, paid-up capital has been used. The source of the information for the four comparison dates is The Statist.[38] Column 9 shows the market capitalisation of the company, which is the paid-up capital, divided by the nominal share value, multiplied by the share price. Column 10 is the sum of the discounted dividends from the date of comparison to the dividend paid in 1914.

[35] Transvaal Chamber of Mines, *Annual Report* 1914, p.258-297

[36] Ibid, p.297

[37] *The Statist*, Vol 37, p.167, p.179

[38] *The Statist*, Vol 34-38

In computing the discounted value of the dividend, it has been assumed for ease of calculation that all dividends have been paid at the end of the year in which the dividend is listed. Column 11 is the difference between the market capitalisation and the sum of discounted dividends detailed above (*e* in Equation 10). A negative value shows that the market value of company is undervalued with respect to the discounted value of future dividends. A positive value, by contrast, shows that the market has overvalued the company with respect to its future dividend payout. Column 12 shows this difference as a percentage of the discounted dividend. The percentage difference is used to generate the frequency distributions shown in Table 6.

Frequency Distributions

Not all mining companies which had paid dividends up to 1914 existed at the date of comparison. However, of the sample of 117 companies which paid a dividend, between 52 and 59 were listed at the various dates of comparison. It must be emphasised that the companies in the summary represent only those which were listed and which paid a dividend between 1886 and 1914. It ignores those which were listed but paid no dividend. Table 6 shows the distribution of the companies according to the percentage difference between discounted dividends and market capitalisation.

Table 6. Frequency distributions of companies by percentage difference between market capitalisation and discounted future dividends

Dec 8, 94	5%	10%	15%	Sep 28,95	5%	10%	15%
<0	-19	-10	-6	<0	-9	-4	-3
1-100	13	18	15	1-100	13	12	6
101-200	7	6	8	101-200	6	5	10
201-300	3	3	4	201-300	5	7	2
301-400	0	4	3	301-400	3	3	5
401-500	0	0	2	401-500	3	2	4
501-600	0	0	2	501-600	2	2	3
601-700	1	0	0	601-700	1	3	1
701-800	1	1	0	701-800	0	1	0
>800	4	6	8	>800	6	9	14
Infinity	4	4	4	Infinity	6	6	6
Total	52	52	52	Total	52	52	52
%Over	63.46%	80.77%	88.46%	%Over	82.69%	92.31%	94.23%
%Under	36.54%	19.23%	11.54%	%Under	17.31%	7.69%	5.77%

Table 6. Frequency distributions of companies by percentage difference between market capitalisation and discounted future dividends (cont')

Jan 4, 96	5%	10%	15%	Oct 10, 96	5%	10%	15%
<0	-16	-8	-5	<0	-16	-7	-2
1-100	12	13	11	1-100	16	15	15
101-200	10	11	7	101-200	7	9	9
201-300	3	5	8	201-300	5	7	5
301-400	2	3	2	301-400	2	4	4
401-500	0	1	4	401-500	1	2	2
501-600	2	1	4	501-600	0	2	5
601-700	0	0	0	601-700	1	0	1
701-800	0	2	0	701-800	0	0	1
>800	4	5	8	>800	6	8	10
Infinity	6	6	6	Infinity	5	5	5
Total	55	55	55	Total	59	59	59
%Over	70.91%	85.45%	90.91%	%Over	72.88%	88.14%	96.61%
%Under	29.09%	14.55%	9.09%	%Under	27.12%	11.86%	3.39%

Regression Analysis

A simple two variable regression model is used to interpret the relationship between the ex post efficient market valuation and the ex ante actual valuation. The results of the coefficients and F-test are given below.

A regression coefficient which is greater than one and which differs significantly from one, indicates that along the regression line, the value of Y (market capitalisation) will be greater than the corresponding value of X (the sum of discounted dividends). In other words, that Y overstates X by some proportion. Of course, the extent to which the market value is under- or over- stated with respect to market fundamentals can be ascertained by the simple addition shown in the respective tables. It is important in evaluating the results of the regressions performed to know whether the regression equation differs significantly from the efficient market hypothesis equation, and whether such a difference could have arisen by chance. In Table 7 below, the results of an F-Test are shown. The aim is to test the hypothesis that c = O and b = 1 in the regression equation Y = bX + c, or simply that Y = X (the efficient market hypothesis).

Table 7. An Efficient Markets F test

* 10%	September 28, 1895 Market Capitalisation Rate	
DFE:	Regression Output:	Unconstrained
Constant		735,463
Std Err of Y Est		1,254,445
R Squared		38.10%
No. of Observations		52
Degrees of Freedom		50
X Coefficient (s)	1.53	
Std Err of Coef.	0.2749	
DFE:	Regression Output:	Constrained
Constant		0
Std Err of Y Est		1,371,894
R Squared		-13.70%
No. of Observations		52
Degrees of Freedom		51
X Coefficient (s)	1.09	
Std Err of Coef.	0.2359	
SSEu:	1.57363E+12	
SSEc:	1.88209E+12	
F Ratio:	4.90	

This is a standard test for testing a set of J linear constraints in a regression with K parameters (including the intercept) and T observations:

$$\frac{\frac{SSE_c - SSE_u}{J}}{\frac{SSE_u}{T-K}}$$

Where : SSE_u is the unconstrained error sum of squares; and SSE_c is the constrained error sum of squares

SSE_c is obtained by running a constrained regression wherein b is constrained to 1 and c is constrained to zero. A new dependent variable is constructed by deducting the independent variable (DFE) from the dependent variable (market capitalisation). This constructed dependent variable is then regressed on DFE, while at the same time forcing the regression through zero.

We will accept the null hypothesis at some confidence level if the computed F ratio is less than the F ratio from the tables of critical points for that level of confidence, and reject it if the computed value is greater. In the above example, the critical value of $F_{0.05}$ with numerator $_{df}$ = 2 and denominator $_{df}$ = 50, is equal to 1.69. We can therefore reject the hypothesis with 95 per cent confidence that in the above regression the intercept may be zero and the coefficient one, since 4.90 > 1.69. The results of the regression using dividends discounted to infinity, is shown in Table 8.

Table 8. Dividends Discounted to Infinity

Date	MCR	Coeff	R-Sq	F-Ratio
Dec 94	5%	0.65	67.03%	23.49
	10%	1.00	64.96%	4.79
	15%	1.35	61.15%	4.12
Sep 95	5%	1.10	47.57%	30.49
	10%	1.53	38.10%	4.39
	15%	1.88	29.75%	10.26
Jan 96	5%	1.38	30.33%	8.59
	10%	1.93	25.64%	6.26
	15%	2.41	20.70%	1.78
Oct 96	5%	0.85	56.42%	34.08
	10%	1.22	49.64%	1.80
	15%	1.57	42.38%	7.97

5. Implications

In the first instance, the quantitative analysis performed in this study clearly indicates that shares were overvalued with respect to their market fundamental value; the market exhibited a profound distortion. Table 6 shows the extent of this overvaluation. At a market capitalisation rate of say ten percent, in January 1896, when stock prices were purported to have slumped, less than twenty per cent of the stocks were undervalued. Even allowing for some error at the margin, this still represents a large overvaluation at a trough in the market trend. Only in December 1894, at the start of this investigation, does the proportion of stocks undervalued at a ten percent discount rate approach twenty percent. Even when a discount rate of five percent is used, the number of companies undervalued does not exceed forty per cent in any period of comparison.

The regression results are equally revealing. The coefficients are generally greater than one and all test significantly different from the efficient market hypothesis at the 95% confidence level. This again indicates a general overvaluation of stock prices relative to market fundamentals.

This overvaluing of stocks relative to market fundamentals could be attributed to two main factors. The first is that the model employed might be misspecified. Section 3, however, discusses in detail the construction of the model and substantiates its application on a theoretical basis. Sufficient support may be found within current financial theory to justify this standard model.

Secondly, it might be possible to attribute the distortion of the market to market inadequacy. The first implication of this line of reasoning is that the market was *weakly* efficient, as defined in section 3. In other words, the fact that prices of shares were high can be attributed to past information about share prices. Either by charting or by using some other technique, investors regarded the market with bullish intent because of trends and indicators observed in historical data. A second possibility is that the market was *semi-strongly* efficient; the prices of shares reflected not only the past performance of the asset but also the publicly available information relating to the asset's future price. This line of reasoning implies that the distortion could have arisen not only from incorrect interpretation of past prices, but also from distorted information gathered by investors. The third possibility stems directly from this and assumes that some investors may have had information that others did not; and because the market was not in the *strong* form of efficiency, these investors were able to exploit this private information.

The evidence presented in section 2 points to the fact that the Randlords had every opportunity to promote market distortion, or at least encourage any distortion which many have been inherent in the market. The mines were not subject to stringent reporting requirements and as a result their owners were under no legal obligation to provide accurate information, or even to provide any information at all. It is relevant to note that many of them chose to register their companies in the Transvaal rather than in London, probably to avoid the stricter reporting requirements of the City, even though these were in themselves not extremely rigorous. If the Randlords did manipulate the market, it says nothing about whether they were speculating or simply attempting to protect their investments. Of course, the answer to this question will require further research, but it is possible to advance the opinion that the differences between protecting an investment and speculating crosses a very fine line, and if their investments needed 'protection', this would seem to imply that their underlying values were somewhat suspect. If the underlying value is suspect then the Randlord, with his privileged information should be aware of this and would attempt to off-load the investment at the earliest opportunity. By keeping it, however, he engages in speculation, simply in the hope of realising capital gains, because by following the argument through, there is no inherent value from which to derive a steady return in the form of dividends in the future, and therefore no point in holding on to the asset.

The Randlords were able to use the Press to provide disinformation on a grand scale. The Statist and the Johannesburg Standard and Digger's News bear testimony to the wealth of information published in respect of working costs and profits. The unsuspecting investor, seeking information to substantiate his investment, could no doubt have drawn comfort from reading each week of how well his company was performing. Unfortunately this 'profitability' was not always realised in the form of a subsequent dividend payout. It is interesting to note that in 1894 and 1895, four companies paid a dividend without producing output for that year (all were newly floated companies); in the years 1896 to 1898 the number was three per year, and in 1899 the number was thirty two (the year of the outbreak of the Boer War).

The indications are that the Randlords had ample opportunity, and motive, to capitalise on a fluctuating market. Steady markets are by definition not opportune for speculators. J. A. Hobson, writing in 1900 and then later in *The Evolution of Modern Capitalism* (1906, 1917, 1928), hints at the possibility that the Randlords may well have benefitted greatly from the War and the Jameson Raid.

The market for shares was overvalued in 1894 -6 and this provides an indication of severe market distortion. Because of their privileged information and ability to diffuse disinformation, the Randlords were well positioned to promote this distortion in order to benefit from stock market activity. They may also have been interested in developing the mines, but only in as much as such development aided and abetted their stock market activity.

BIBLIOGRAPHY

Blainey, G. "Lost Causes of the Jameson Raid." *Economic History Review* 18 (1965) : 350-66.

Brealey, Richard A., and Stewart C. Myers. *Principles of Corporate Finance*. Fourth ed. London: McGraw-Hill, 1991.

Cartwright, A. P. *The Corner House, the early history of Johannesburg*. Cape Town, 1965.

Curle, J. H. *The Gold Mines of the World*. First ed. London: Waterlow & Sons, 1899.

----. *The Gold Mines of the World*. Third ed. London: George Routledge & Sones., 1905.

De Kiewiet, C. W. *The Imperial Factor in South Africa*. Cambridge: Cambridge University Press, 1937.

Denny, George, A. *The Deep Level Mines and their Future Development*. London: 1902.

----. "The Commercial Aspect of Rand "Profits"". Reprinted from *the Mining Journal*, 1907.

Denoon, D. J. N. "The Transvaal Labour Crisis, 1901-6." *Journal of African History*, 7 (1967) : 481-94.

----. "Capital and Capitalists in the Transvaal in the 1890s and 1900s." *The Historical Journal* 23 (1980) : 111-32.

Emden, Paul H. *Randlords*. London: Hodder and Stoughton, 1935.

Flood, Robert P., and Peter M. Garber, eds. *Speculative Bubbles, Speculative Attacks and Policy Switching*. London: MIT Press, 1994.

Flood, Robert, P., and Robert J. Hodrick. "On Testing for Speculative Bubbles." *Journal of Economic Perspectives* 4 (1990) : 85-101.

Frankel, S. H. "Return to Capital Invested in the Witwatersrand Gold-Mining Industry, 1887-1932." *Economic Journal* 45 (1935) : 67-76.

----. *Capital Investment in Africa*. London: Oxford University Press, 1938.

----. *Investment and Return to Equity capital in the South African Gold Mining Industry, 1887-1965, an International Comparison*. Oxford, 1967.

Garber, Peter M. "Famous First Bubbles." *Journal of Economic Perspectives* 4 (1990): 35-54.

Garrett, F. E., and E. J. Edwards. *The Story of an African Crisis*. Westminster: Archibald Constable & Co, 1987.

Goldmann, S. C. *The Financial, Statistical and General History of the Fold and Other Companies of the Witwatersrand, South Africa*. Cape Town: Argus Printing & Publishing Co, 1892.

----. *South African Mines; Their Position, Results and Developments : Rand Mining Companies*. Vol. I, 1895-96a.

----. *South African Mines; Their Position, Results and Developments : Miscellaneous Companies*. Vol. II, 1895-96a.

Hammond, John Hays. *The Truth About the Jameson Raid*. Boston: Marshall Jones Company, 1918

Hammond, Natalie. *A Woman's Part in a Revolution*. London, 1897.

Hatch, F. H., and J. A. Chalmers. *The Gold Mines of the Rand*. London: MacMillan and Co, 1895.

Hay, Donald, and Derek Morris. *Industrial Economics and Organisation*. Second ed. Oxford: Oxford University Press, 1991.

Hobson, J. A. "Capitalism and Imperialism." *The Contemporary Review* 77 (1900) : 1-17.

----. *The Evolution of Modern Capitalism*. London: Scott Publishing Co., 1917.

Jacobssen, D. *Fifty Golden Years of the Rand, 1886-1936*. London: Faber & Faber Ltd, 1936.

Jeeves, Alan. "Aftermath of Rebellion - The Randlord's and Kruger's Republic after the Jameson Raid." *South African Historical Journal* 10 (1978) : 102-16.

Jeeves, A., and M. Fraser. *All That Glittered : Selected Correspondence of Lionel Phillips 1890-1924*. Cape Town: Oxford University Press, 1977.

Kubicek, R. V. "The Randlords in 1895: A Reassessment." *Journal of British Studies* XI (1972) : 84-103.

----. *Economic Imperialism in Theory and Practice : The Case of the South African Gold Mining Finance 1886-1914*. Durham, N.C.: Duke University Press, 1979.

Mabson, R. R. *Mines of the Transvaal*, Fourth ed. London: The Statist, 1907.

Marks, Shula, and Stanley Trapido. "Lord Milner and the South African State." *History Workshop* 8 (1978) : 50-80.

Marais, J. S. *The Fall of the Kruger Republic*. Oxford: Clarendon Press, 1961

Mawby, A. A. "Capital, Government and Politics in the Transvaal, 1900-1907: A Revision and a Reversion." *The Historical Journal* 17 (1974) : 387-415.

Mendelsohn, Richard. "Blainey and the Jameson Raid : The Debate Renewed." *Journal of Southern African Studies* 6 (1980) : 157-70.
Mills, Terence C. *Predicting the Unpredictable?* London: Institute of Economic Affairs, 1992.
Newbury, Colin. *The Diamond Ring.* Oxford: Oxford University Press, 1989.
Parker, William N., ed. *Economic History and the Modern Economist.* Oxford: Basil Blackwell, 1986.
Porter, Andrew N. "British Imperial Policy and South Africa 1895 - 9." *In The South African War : The Anglo-Boer War 1899-1902,* edited by Peter Warwick, Harlow, UK: Longman, 1980.
Rappaport, Alfred. *Creating Shareholder Value.* New York: The Free Press, 1986.
Richardson, Peter and Jean-Jacques Van Helten. "The Gold Mining Industry in the Transvaal 1886-99." In *The South African War : The Anglo-Boer War 1899-1902,* edited by Peter Warwick, Harlow, UK: Longman, 1980.
----. "The Development of the South African Gold Mining Industry, 1895-1918." *Economic Review* 37 (1984) : 319-40.
Robinson, R., J. Gallagher, and A. Denny. *Africa and the Victorians : The Official Mind of Imperialism.* London: MacMillan & Co., 1963.
Rosenthal, E. *Gold! Gold! Gold!* London: MacMillan, 1970.
Shiller, Robert J. *Market Volatility.* London: MIT Press, 1990.
----. "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?" *American Economic Review, Papers and Proceedings* 71 (1981): 421-36.
----. "Speculative Prices and Popular Models." *Journal of Economic Perspectives* 4 (1990): 55-65.
Shleifer, Andrei, and Lawrence H. Summers. "The Noise Trader Approach to Finance." *Journal of Economic Perspectives* 4 (1990): 19-33.
Stiglitz, Joseph E. "Symposium on Bubbles." *Journal of Economic Perspectives,* 4 (1990) : 13-18.
The Johannesburg Standard and Digger's News
Transvaal Chamber of Mines : *Annual Reports*
The Statist
Truscott, S. J. *The Witwatersrand Goldfields.* London: MacMillan & Co., 1902.
Van Der Poel, Jean. *The Jameson Raid.* London: Oxford University Press, 1951.
Wheatcroft, Geoffrey. *The Randlords.* London: Weidenfeld and Nicholson, 1958.
White, Eugene N. "The Stock Market Boom and Crash of 1929 Revisited." *Journal of Economic Perspectives* 4 (1990) : 67-83.
Wilson, Monica, and Leonard Thompson. *The Oxford History of South Africa : South Africa to 1870.* Vol. One. Oxford: Clarendon Press, 1969.
—. eds. *The Oxford History of South Africa : South Africa 1870-1966.* Vol. Two. Oxford: Clarendon Press, 1971.
—. *A History of South Africa : Social and Economic.* London: Oxford University Press, 1941.
Withers, H. *Stocks and Shares.* London: Smith, Elden & Co., 1910.