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Mark-ups and competition: a comparison of the profitability of listed South African industrial companies

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Abstract

This paper tests the well established finding in the literature that SA firms are significantly more profitable and operate in a highly concentrated market, relative to that of their foreign counterparts. In particular we question the conclusions drawn by Aghion, Braun, and Fedderke (2008) who find that South African firms enjoy profitability margins more than double that in other countries for a sample from 1980 to 2004. We test this claim empirically by using survivorship bias corrected datasets of the top 25 South African industrial firms listed on the JSE (by market capitalisation) and those in the Dow Jones Industrial Average index. We compare (for this period) the mark-ups (as measured by Aghion et al. (2008)) as proxied for by the relative profitability (as measured by Return on Equity (ROE) and Return on Invested Capital (ROIC)). We also compare a set of commonly used ratios for SA firms relative to their US, UK and Brazilian counterparts for the period 1994–2013. Our results for both data sets do not confirm the claim that South African industrial companies have enjoyed sharply higher mark-ups as approximated by the relevant rates of profitability when compared with their international counterparts.

Keywords:
Competitiveness, Profitability Margin, Return on Equity, Return on Assets, Return on Invested Capital, Mark-ups, Profit Margins, Gross Margins
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1. Introduction

It is widely accepted that competitive markets bring with them the benefits of increased innovation and productivity growth. This consensus has been the driving force for the development of competition legislation throughout the world and, although specific frameworks may differ, the common goal is to increase allocative efficiency and limit monopoly power. Competition promises to provide incentives for efficient production and innovation and downward pressure on both costs and prices (Nickell, 1996, pp. 724–725). While the end goal is an efficient market stemming from a satisfactory level of competition, defining a precise and all encompassing measure of competition is impossible due to the complex inter-linkages between factors contributing to and arising from market structure and price-setting behaviour. To this end an eclectic approach is generally adopted in the literature, taking both structural factors (such as market share and market concentration) as well as performance orientated factors (such as trends in price, cost, profit and production levels) into account.

Aghion, Braun, and Fedderke (2008) (ABF hereafter) concluded that South African (SA hereafter) manufacturing firms operate in relatively uncompetitive markets based on their empirical observations that these firms have been able to generate abnormal profits when compared to their counterparts in other markets. More specifically, ABF (2008) claim that SA manufacturing firms have consistently been more profitable on a comparable basis over a period extending from the mid 1960s through to 2006. Using various estimates of mark ups and profitability, they suggest that SA firms have been between 50% and 100% more profitable than their international peers, hinting strongly at the need for stricter competition policies to protect the South African consumer.

In a South African context, where economic growth is stalling and levels of poverty and inequality remain chronically high, ensuring that markets are as competitive and efficient as possible is of unquestionable importance in the policy framework. While it may at times be infeasible to dramatically adjust the structure of a certain industry, the legislation can adjust conduct through the prohibition of activities or imposition of fines for conduct which is deemed to substantially prevent or lessen competition. [1] The findings of Fedderke, Kularatne, and Mariotti (2007), Fedderke (2013) and ABF (2008)

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[1] C.f. Reekie (1999)'s summary details of the competition policy act of 1998

could thus be interpreted as having serious implications for policy makers in terms of the market structure and profitability of South African firms. In fact, Fedderke (2013) points out that the starting point for his recommendations on policy interventions to stimulate growth and employment creation, are these established findings on industrial conduct as measured by pricing power in the South African industry. The studies all suggest that mark-ups, and thus by implication the price paid for by the consumer, are excessively high in South Africa and could be detrimental to the above stated goals of meeting social and economic development needs.

In response to this, we examine the empirical validity of this claim using a smaller, but more detailed data set based on the annual financial statements of the largest listed industrial companies based in SA and the United States (US) for the period 1980 to 2013. To deal with the potential impact of survivorship bias, we construct a market capitalisation based index of the annual top 25 industrial firms for SA over this period. We then compare the profitability of these firms using the same measures applied by ABF (2008) and find that this profitability "premium" simply does not exist for these firms for this period. Although the dataset used in this study is smaller than the ABF (2008) dataset in terms of firm coverage, their result needs to hold for the smaller datasets as well. Fedderke (2013, p.8) also points out that since the 1990s, large South African firms have shown dramatically higher mark-ups than comparatively smaller firms, which underlines the appropriateness of our detailed comparison of the largest firms in SA and the US. He also argues that *"the rate of increase (in profitability) for (the large) South African firms has considerably outpaced that of large firms internationally."* With this in mind, our finding of a relative decline in large SA firms profitability as compared to their US counterparts since the 1990s contradicts the established literature on pricing power in South Africa. In summary then, if the high mark-ups are not found for the largest industrial firms in an environment where these firms account for large proportions of their respective market shares, then ABF (2008)'s results about the lack of competition in the industrial sector simply does not stand.

In addition to this, we extend our detailed analysis to compare the profitability of SA firms relative to the United Kingdom (UK) and Brazil, using profitability ratios extracted from Bloomberg for the period 1994 – 2013. Our findings similarly suggest that SA industrial firms are not excessively profitable as shown in earlier work.

The paper is set out as follows: section 2 reviews the literature relating

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to competition policy and economic growth. Sectiondata discusses the data that is used in this study, while section 4 outlines the methodology to assess the relative competitiveness of firms in the dataset. The results are then discussed in section 5, and we conclude in section 6

2. Literature Review

In order to understand the use of profitability ratios as proxies for the level of competition in a given market, it is necessary to first explore the theory surrounding linkages between market structure and performance.

The seminal study into the relationship between market structure and profitability was done by Bain (1951). This provided insight into the use of profitability ratios as proxies for the level of competition in a given market. After finding a statistically significant difference between mean profits in industries with high and low concentrations, he argued that the structure of a market (concentration) determined the conduct of firms (price-setting behaviour), which in turn determined the performance (profitability). Accordingly in more concentrated markets where firms have more market power, they will charge higher prices and earn higher profits. This precipitated a growth in literature seeking to develop theoretical links between market structure and outcomes in what became known as the structure conduct performance (SCP) framework. While Bain (1951)'s theory received initial empirical support from cross-country regressions it was later challenged by Demsetz (1973) who argued that this was merely correlation between market structure and profitability, with efficiency being the independent causal force determining profits rather than market structure.

There has subsequently been considerable debate regarding this structuralist framework, with opponents arguing that concentration itself does not necessarily imply excessive profitability. [2] Instead individual market shares influence profitability, which are determined by relative efficiency, with more efficient firms tending to be larger.

On the other hand, proponents of the framework, such as Fourie and Smith (1993) and Fourie (1996), argue that the relationship between market share and profitability arises from market power rather than efficiency. As such concentration is detrimental to general market efficiency. Fourie and

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[2]C.f. Leach (1992) and Reekie (1999) in this regard.

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Smith (1998, 1999) summarize some of the empirical and methodological difficulties which leave this debate unresolved. These include the numerous and ambiguous linkages, the inability to prove causality in a framework with complex simultaneous relationships in which most variables are endogenous and the heterogeneity of the relationship over time and industry type. Together this points towards the value of an eclectic approach in which both structure and performance are investigated, rather than assuming certain conduct and performance will automatically flow from a given structure.

With regards to the structure of the South African manufacturing sector, the literature dates back several decades (c.f. Du Plessis (1978) for an early example, where the SCP framework had been employed). In this regard it has been, e.g., established by Fourie (1996) and Fedderke and Szalontai (2009), among others, that absolute concentration in SA had historically been high. Theron (2001, p.635) states that this is true for other sectors as well with concentration indices for South Africa being "twice as high as those of industrialised countries". She does, however, also state that such a characteristic is common among other developing countries.

Despite these and other findings, conclusions drawn purely from structural characteristics on the state of competition in South Africa will be weak. As Fourie (1996, p. 58) emphasises, "the focus must be on positions of dominance and the abuse of economic power by dominant firms in particular markets", which necessitates an evaluation of the conduct and performance of firms.

Such a view is also in line with the move towards effects-based analysis in competition investigations, where the focus is placed on the likely impact on consumers and downstream firms. It is within this context that studies into the relative profitability of South African firms are of value, as they focus on the mark-ups and hence the prices which firms are charging; factors which directly impact on consumers. The first notable paper on the subject was Fedderke, Kularatne, and Mariotti (2007), who compared the profitability of the South African manufacturing sector to that of the US. They used annual panel data for the manufacturing series at the three-digit SIC level for the period 1970 to 1997. Their approach followed the methodological innovations of Roeger (1995), which they extended by using a Pooled Mean Group Estimator (PMGE) as proposed by Pesaran, Shin, and Smith (1999), which allows for heterogeneity across industries in terms of intercepts, short run coefficients and error variances, while imposing homogenous long-run

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coefficients across industries. This followed warnings of data quality [3] and the earlier empirical and methodological issues highlighted. Fedderke et al. (2007)'s findings suggest that South African manufacturing industries are significantly more profitable than comparable firms in the U.S. From this they infer, based upon their formulas for the profitability ratios, that South African manufacturing firms on aggregate also charge mark-ups which are approximately double that of the U.S average. Their estimate of the unadjusted long-run value for the mark-up across industries in SA is around 80%, compared with an average result of 45% for the literature on industries in the USA. These results were then extended by controlling for various factors associated with the size of the mark-up, following *inter alia* Oliveira Martins and Scarpetta (1999). The latter result is evidence that the mark-up in South African industries can sensibly be split into a constant component and a statistically significant counter-cyclical component.

Fedderke et al. (2007, p. 52) also controlled for the discipline that international trade might impose on the size of mark-ups in domestic industry. They find evidence supporting the intuitively plausible effect that greater exposure to import and export competition is associated with lower mark-ups. However, the subtlety of their result is to distinguish within-industry and between-industry effects for international competition and they found that the between-industry effect is the more powerful. The authors also returned to the long-standing debate on market structure and mark-ups and found a powerful association between industry concentration and mark-ups, implying greater concentration is associated with higher mark-ups. As Fedderke et al. (2007, p. 54) argued, competition policy aimed at lowering the degree of concentration in industry could, theoretically, lower pricing power of firms and in that way improve the competitiveness of South African industry. Furthermore, they explored the association between mark-ups and unit-labour cost as a measure of industry competitiveness. Again the results are subtle: an increase in within-industry cost-competitiveness lowers the mark-up, while an increase of cost competitiveness for an entire industry relative to the average for the manufacturing sector enjoys a higher mark-up, i.e. the increased cost competitiveness is not passed on to customers (Fedderke et al., 2007, pp. 56–57).

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[3]ABF (2008) e.g. warned that "...the reliability of all results based on industry data are likely to decline substantially after 1996".

The results from Fedderke et al. (2007) mentioned up to this point suggests that South African industrial firms enjoy high mark-ups on an international comparison and that the mark-ups are related to characteristics of the South African industrials landscape, such as high concentration ratios. These findings confirm earlier evidence based on a multivariate co-integration model for inflation in South Africa by Fedderke and Schaling (2005). They estimated an average mark-up of 30% over unit labour cost for the South African economy, which was three times as large as comparable estimates for the United States (Ghali, 1999).

However, Fedderke et al. (2007, p. 58) also report one final result that casts some ambiguity on these findings. When adjusting their mark-up estimate to allow for intermediate goods, they find a considerably reduced mark-up for South African industry. Not only is the estimate sharply lower for domestic firms[4], but it is also lower than comparable estimates for the USA [5]. To this the authors offer two explanations: firstly, they speculate that there might be an errors-in-variables problem with the data on intermediate inputs, and secondly, that there might be an omitted variable bias. They offer evidence that incorporating concentration ratios as the potentially omitted variables yields an estimate of the local mark-up that is higher than the comparable figure for the USA[6] (Fedderke et al., 2007, see pp. 59-60).

ABF (2008) extended the work of Fedderke et al. (2007) in three directions: firstly, they calculated mark-ups and other measures of profitability for South African industry using three data sets (an industry level panel data set from UNIDO, an industry level panel from TIPS and a firm level panel for listed companies) for South Africa and a large international cross section.[7] Secondly, they examined these measures of profitability over time and controlled for measures of product market concentration and, finally, they studied the association between product market competition (as measured) and their estimate of productivity growth.

For the purposes of our analysis, the firm-level panel results of ABF

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[4]There estimate is in the range of 6% to 9%.

[5]The US estimate is approximately 13%.

[6]Fedderke et al. (2007, p. 59)'s concern that "*South African data on intermediate inputs is not fully reliable*" is correct, but extends also to the other data used in studies of this kind, including especially industry concentration ratios.

[7]ABF (2008)'s firm level panel contained data for listed companies in 56 countries, including South Africa, for the period 1980 to 2004.

(2008) are of most interest, as this study offers firm level calculations as a robustness check. They found that listed South African firms earned profits on average around 50% higher than the international average when profitability was measured in terms of Net Income/Sales, Net Income/Assets and Net Income/ Equity. In contrast though, the same South African firms had much lower Gross Margin, Market to Book Ratio and Price-Earnings Ratios. They also found no evidence of systematic variation over time for these measures of profitability, nor evidence that large firms enjoyed higher profits than smaller firms (ABF (2008), pp.11-12). These are the results that are contested in this study, where we use a market capitalization index of SA and US firms. We then further extend this detailed approach to compare SA industrial firms to that of their Brazilian and UK counterparts, representing an additional developed– and developing (resource dependent) market economy, respectively.

3. Data Section

3.1. Data Collection Motivation

It has long been recognised that empirical studies based on data of listed companies can be subject to the effects of survivorship bias. This occurs when a sample is drawn only from the firms which are currently listed for which a historical series is then constructed in a backward-looking manner. This nave selection will lead to biased historical estimates as it systematically ignores the results or data from firms that used to be listed but no longer form part of the relevant index. By excluding the firms that are no longer listed, data is collected only for the firms that have survived. In the context of our study, such a biased sample of firms and their returns would probably lead to exaggerated estimates of mark-ups and profitability, because it is usually the most profitable firms that survive. Overcoming this problem, we carefully identify and include in the firms that are no longer listed[8] over the entire sample. Although our study seeks to challenge the findings of Aghion et al. (2008), the authors do not clearly specify which firms were included in

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[8]Firms may no longer be listed for several reasons. They can go bankrupt or decide to de-list. Alternatively their market identities can change due to specific corporate actions, e.g. mergers, acquisitions or restructurings. The effect is the same from a survivorship bias perspective.

their analysis[9]. Table A2 in their study suggests that the data was sorted by 3 digit (SIC) manufacturing industry. Table A3 then compares the ratios of the listed companies to those of the industry level as computed from the UNIDOs International Statistics data base. However there is no further discussion in the text of the nature of the firm level data set used. This very brief discussion does not explain how many companies were included for each country, or whether the data set has been corrected for survivorship bias.[10]

Due in part to the lack of clarity on the issues raised above, we decided to create a new firm-level data set, corrected for survivorship bias, in order to test the robustness of Aghion et al. (2008)'s claims. As is discussed in more detail in the next section, the use of indices is a practical way of dealing with the survivorship bias problem. By using component lists of comparable market capitalisation based indices for each year for the two markets we are able to identify a complete, but manageable, list of firms to be included in the analysis. We then establish the extent to which survivorship bias exists in the data. This is a major advance over the data set used by Aghion et al. (2008). However, this clarity comes at a price: the complexity of the data collection process limited us to the detailed comparison of only a few markets SA, the US, the UK and Brazil.[11]

3.2. Data Collected

A key challenge was the construction of a list of SA industrial firms which would be comparable to a sample from the United States summarised by the Dow Jones Industrial Average (DJIA) index for the period 1980-2006. No such list existed for this period.[12]

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[9]According to Aghion et al. (2008, [p.7) "*The firm-level evidence is based on Worldscope data for publicly-listed companies in 56 different countries since the early 1980s. The dataset contains yearly balance sheet and P&L items, and other basic firm characteristics.*"

[10]Given the long period (1980–2006) studied by Aghion et al. (2008), the chances are assumed high that their sample is drawn from an incomplete list of firms. If their data is indeed exposed to survivorship bias, it may help to explain the difference in findings from our analysis.

[11]Although not as broad as the Aghion et al. (2008) study, our analysis allows a direct comparison with the claims advanced by Fedderke et al. (2007) in terms of SA's competitiveness w.r.t. the US industrial market.

[12]In 2002 the JSE adopted the FTSE index classification methodology. This was a completely different system to that used previously. Indices were only retroactively constructed back to 1998. Data relating to indices for earlier periods have not been maintained.

The first set of data used was collected at the firm level for listed industrial companies making up a top 25 industrial share index for the SA market (based on market capitalization weights)[13] and the DJIA for the US for the period 1980 – 2013. Firstly, the number of ordinary shares in issue and the share prices at each financial year-end was collected, after which the market capitalisation could be calculated for each company. Secondly, the top 25 firms on market capitalisation were identified for each year from 1980 to 2013 and these defined the index. The DJIA was then chosen as the representatitve US industrial firm index. It is made up of 30 shares of a wide range of industrial firms. The lists for the included SA and DJIA firms are included in table Appendix B in the appendix. The extent of the remaining survivorship bias due to incomplete data is summarised in table 1 below.

Table 1: Extent of Survivorship Bias: 1980-2013

Ratio	Required Observations	Observations	%
S.A			
Profit Margin	850	811	95.4%
R.O.E	850	846	99.5%
R.O.A	850	842	99.1%
DJIA			
Profit Margin	1020	869	85.2%
R.O.E	1020	894	87.6%
R.O.A	1020	896	87.8%

As there is some ambiguity in the profitability definitions used in ABF (2008), we used a broad range of potential definitions to ensure comparability. For example, the authors did not define the profitability measures used in their ratios. Net Income, e.g., could be interpreted as Operating Profit, Profit before Interest and Tax (PBIT) or Net Profit after Tax (NPAT). Secondly,

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[13]Following ABF (2008)'s reasoning one would assume that the largest industrial firms in SA exert the most market power. Indeed, ABF (2008), 10 confirms large manufacturing firms in SA as being relatively more profitable than smaller firms. Our investigation of the largest industrial firms by market capitalisation should, therefore, serve as a robustness check for their results.

"assets" could refer to either total assets[14] or net assets[15]. In our analysis we use total assets as it gives a measure of performance that reflects the total stock of long and short-term assets used by the company to generate the profits for that period. ABF (2008) also uses the following ratios as proxies for mark-ups and profitability: Net Income / Sales; Net Income / Assets; Net Income / Equity; Gross Mark-up; Market to Book ratio and Price to Earnings ratio.

Due to limited data availability for some of the firms with respect to the income statement and market data variables at financial year-end, we were only able to calculate comparable results for the first three ratios, but this is precisely where we wish to confirm the robustness of the ABF (2008) results as it is for these three ratios that the South African firms exceeded the international average by 50% according to the authors.[16] Our analysis thus looks at the NPAT[17]/Sales (Profit Margin), NPAT/Assets (R.O.A) and NPAT/Equity (R.O.E).

In addition to the detailed dataset above, our second dataset considered several measures of profitability obtained from Bloomberg. These were Gross Margin, Profit Margin, Return on Assets, Return on Company Equity, Price-Earnings Ratio and Price to Book Ratio.[18] These ratios were then obtained for South African, US, UK and Brazilian listed industrial companies as well as for those companies in the DJIA for the period 1994-2013 at an annual frequency.[19] Although the number of observations are limited, the period

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[14]Total assets = fixed + current assets

[15]Fixed assets + net current assets = current assets - current liabilities

[16]Also, ABF (2008) argues that the ratios mentioned here that are not listed in our study can be regarded as symmetrical in their results to those included, implying that our results could be considered as a detailed robustness check to their findings.

[17]Net Profit After Tax

[18]In all cases the ratios calculated by Bloomberg were used, which provides the benefit of comparability between countries.

[19]The initial hope was that the frequency could be increased to quarterly intervals, however, the ratios for most South African companies were only available at a semi-annual or annual frequency while the U.S companies were available either quarterly or annually. Furthermore, when the semi-annual data was available for South African firms it was not available as far back as the annual data, thereby mitigating any benefit of additional observations. Also, the observations start at 1994 due to sparse data availability for earlier periods the abovementioned ratios

from 1994 onwards is important, as it was post 1994 that South African market started opening up to foreign trade, capital flows, investment and foreign competition. The full list of included companies for this data set is in the appendix. Here we use the top 30 industrial companies in the US, to make the comparison with the other three countries more direct.[20]

In this dataset, we once again dealt with the issue of survivorship bias. To do so, the industrial equities for each country were ranked according to their market capitalisation at the end of 2013. The top 30 companies on record were then included in the sample for each year.[21] In doing so care was taken not to include any preference shares so as to avoid duplication or bias in the price ratio series. The extent of the survivorship bias resulting from missing data is shown in table 2 below. As can be seen the bias is again minimal, with the exception of Gross Margin for S.A and the U.K and the price ratios for Brazil.

While our approach does not eliminate all of the survivorship bias, since the series are still constructed in a backward-looking manner with inclusion being dependent on 2013 market capitalisations, it does significantly minimise it by ensuring that there are as close to 30 companies included in each year as possible.[22] The potential for any bias to impact upon the results is further minimised by the relatively short sample period, compared with the preceding data set, and the fact that identical procedures were followed for the inclusion of companies in each of the four countries.

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[20]The same screening criteria was applied to the national stock exchanges of South Africa, the U.S, the U.K and Brazil, which further adds to the comparability between the respective median series for the various measures of profitability. Specifically, for each country an equity screen was run on its national stock exchange to identify industrial equities for companies which are domiciled within its borders.

[21]For a company to be 'on record' there needed to be data available for at least some of the Bloomberg calculated ratios in a given year. As such a company was included if the data happened to be missing for a specific ratio or if no data happened to be available in the year of interest but had been available in one of the preceding years. Therefore there are some missing data points.

[22]The only country for which 30 equities could not be obtained for the period 1994-1998 was Brazil. This follows as out of all the equities classified as 'industrials', there are less than 30 for which Bloomberg has a record of for Brazil during that period.

Table 2: Extent of Survivorship Bias:1994-2013

Ratio	Required Observations	Observations	%
S.A			
Gross Margin	600	386	64.3%
Profit Margin	600	596	99.3%
R.O.E	600	564	94.0%
R.O.A	600	570	95.0%
P.E	600	568	94.7%
Price to Book	600	572	95.3%
U.S			
Gross Margin	600	505	84.2%
Profit Margin	600	592	98.7%
R.O.E	600	583	97.2%
R.O.A	600	581	96.8%
P.E	600	580	96.7%
Price to Book	600	580	96.7%
U.K			
Gross Margin	600	444	74.0%
Profit Margin	600	597	99.5%
R.O.E	600	555	92.5%
R.O.A	600	589	98.2%
P.E	600	550	91.7%
Price to Book	600	547	91.2%
Brazil			
Gross Margin	600	543	90.5%
Profit Margin	600	564	94.0%
R.O.E	600	516	86.0%
R.O.A	600	542	90.3%
P.E	600	352	58.7%
Price to Book	600	422	70.3%

Once the relevant equities had been identified and included, the median was then calculated for each country and year across the range of ratios. In addition to Profit Margin, Return on Assets and Return on Equity, median series were also created for Gross Margin, Price to Book Ratio and Price-Earnings Ratio. With respect to Return on Assets and Return on Equity, the

South African median series were adjusted for depreciation in the Rand. An adjusted median series was calculated for depreciation relative to the Dollar and Pound by subtracting the year on year percentage change of the average annual Rand-Dollar and Rand-Pound exchange rates respectively. To facilitate a comparison between South Africa and Brazil, both countries' relevant median series were adjusted by their respective real effective exchange rates. The median series of South Africa were then compared with those of the other three countries over time by looking at average annual medians and using a non-parametric test on the distributions, discussed next.

4. Methodology

4.1. South Africa – Dow Jones Industrial Average Comparison

For both the top 25 SA industrial firms, and the DJIA, included since 1980 we calculate three series of median profitability for each of the ratios used. This allows for direct comparison of the aggregate profitability ratios for each country in the dataset. We then analyze the data by comparing the number of times each country's aggregate ratio exceeds that of the other (relative to SA firms), while also comparing the distributional characteristics of the respective median ratio series using the non-parametric tests. This implies we test for each profitability ratio whether industrial companies in SA have a stochastically larger distribution, on aggregate, than for comparable series of firstly the DJIA (1980–2013) and also for the US, UK and Brazilian top 25 industrial firms for the period (1990 – 2013).[23] To achieve this, we use the two-sample Wilcoxon-Mann-Whitney, the Wilcoxon signed-rank and the Kruskal-Wallis non-parametric tests, respectively. For each of these we test for the one-sided alternative hypothesis that SA firms have larger aggregate median stochastic distributions than their foreign counterparts.

The first non-parametric test used is the two-sample Wilcoxon-Mann-Whitney (WMW) rank-sum test suggested by Wilcoxon (1945) and built on by Mann and Whitney (1947).[24] This procedure ranks the medians and tests the null hypothesis that the two samples have identical distributions. The one-sided test alternative used here tests whether SA firms have higher

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[23]For Brazil, the Price / Earnings and Price to Book ratios only date back to 1994 and the tests were subsequently adjusted to account for this.

[24]There is debate on the exact name for this test, including the Wilcoxon rank-sum test or the Mann-Whitney U test. We will refer to this as the WMW test hereafter.

median distributions.[25] The test does not require the assumption of normal distributions, as does its parametric counterpart, the two sample t-test.

The WMW test involves ranking the medians of the relevant ratio series. First we add up the ranks for the observations which came from sample 1, with the ranks from sample 2 then determinate as all the sums need to equal $N(N+1)/2$ (where N is the total observations, and n_1 & n_2 the sample sizes of the two series respectively). The U statistic is then calculated as:

$$U_1 = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1 \tag{1}$$

where R_1 is the sum of the ranks in the first sample. The U-statistic for the second sample follows intuitively, with the sum of the U-statistics then used in comparison to significance tables. The output given in the results below are the 95% confidence p-values which estimate the probability that a randomly chosen firm from the first series (SA) has a higher median than a randomly chosen subject from the other series (US, UK or Brazil).[26] In addition to this, we also provide p-values for the Wilcoxon signed-rank test, which is similar in spirit to the WMW test. The difference is that for this test, each year the median profitability ratios are compared, with an equal stochastic distribution leading to roughly equal positive and negative differences of roughly equal magnitude. In this test, the differences, $D_i = SA_{median,t} - US_{Median,t}$, are then ordered by absolute values and ranked, with the expected rank sums assigned to positive and negative differences, assumed under the null to be equal (Wackerly, Mendenhall, and Scheaffer, 2007).[27] Intuitively, this implies under the null that the $k^t h$ largest D_i should be positive or negative with equal probability, and the assignment of the ranks to the two series are equally likely too.

Finally, we also report the Kruskal-Wallis (KW) test statistic p-value for comparing the equality of stochastic distributions between the profitability ratios of SA, US, UK and Brazilian firms for the period 1990 – 2013.[28] The

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[25]As the WMW test is an ordinal test, medians are used.

[26]Formally stated, the alternative is that the population relative frequency distribution of series 1 is shifted to the right of the relative frequenct distribution of series 2.

[27]As with the WMW, the Wilcoxon signed-test compares the null to the alternative of a right-shifted location of the SA industrials, indicating that it has a larger stochastic distribution.

[28]The KW test is essentially the generalized version of the WMW test above.

null hypothesis assumes that the 4 samples have equal stochastic distributions, while the alternative suggests that at least two countries differ in terms of their distributions.[29] Failure to reject the null would thus imply that the four countries have similar profitability ratio distributions for the period. The test statistic can be derived by considering again the rank sums of the medians of the profitability ratios. If R_i denotes the sum of the ranks of the aggregate profitability medians from country i, then let $\hat{R}_i = R_i/n_i$ denote the average of the ranks, and $\bar{R}$ the average of all of the ranks. If we define V as:

$$V = \sum_{i=1}^{4} n_i(\hat{R}_i - \hat{R}) \tag{2}$$

then we would expect, under equal stochastic distributions, the value of V to be close to zero. Kruskal and Wallis (1952) instead focusses on the H statistic, which can be written as:

$$H = 12.V.[n(n+1)] \tag{3}$$

or alternatively:[30]

$$H = \frac{12}{n(n+1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i} - 3(n+1) \tag{4}$$

5. Results

5.1. South Africa – Dow Jones Industrial Average profitability comparison

According to Aghion et al. (2008, p.11–12), listed firms in SA exhibit 50% higher profitability when measured using Net Income / Sales, Net Income / Assets and Net Income / Equity ratios when compared to the firms in the 56 countries included in their Worldscope database. Fedderke et al. (2007)

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[29]C.f. Hollander and Wolfe (1999, table A.12) for small sample statistics; with Kruskal and Wallis (1952) also showing that the approximate chi-square distribution is valid if the size of the samples exceed 5.

[30]With V rewritten as: $V = \sum_{i=1}^{4} n_i \left(\bar{R}_i - \frac{n+1}{2}\right)^2$. Notation follows that of Wackerly et al. (2007, p. 733).

also found that profitability ratios in SA were nearly double that of their US counterparts. In contrast, the results for our profitability margin ratios, based on detailed firm level data for the US and SA and controlled exchange rate depreciation and survival bias, show a strikingly different conclusion. Tables 3 and 4 below show information on the aggregate medians for the US and SA firms (see 3.2 for definitions of ratios):

Table 3: Comparison of Profitability Ratios (S.A v DJIA): 1980-2013

	Profit Margin	R.O.A	R.O.E
S.A	6.7%	0.1%	12.9%
DJIA	7.1%	5.8%	16.7%
Correlation Coefficient	-0.17	-0.03	0.11
% of time S.A > DJIA	44%	29%	41%

Table 4: Comparison of Profitability Ratios (S.A v DJIA) by Decade

	1980's		1990's		Post 2000	
	S.A	DJIA	S.A	DJIA	S.A	DJIA
Profit Margin	6.9%	5.1%	6.8%	6.0%	6.6%	9.4%
R.O.E	7.8%	14.3%	13.0%	16.7%	16.4%	18.5%
R.O.A	-5.4%	5.6%	0.0%	5.3%	4.1%	6.3%

From the tables above, there is no clear evidence that the respective ratios are consistently higher for SA industrial firms compared to the DJIA. In fact, the results suggest the converse, with the median profitability ratios being greater for the US for all three ratios. Comparing the medians by decade, SA firms were more profitable than their US counterparts using the Profit Margin ratio only during the 1980s and 1990s. For the other two measures, each decade has shown higher aggregate median ratios for the US.

Table 5 below shows the p-values for the two-sample Wilcoxon-Mann-Whitney and the Wilcoxon signed-rank tests, discussed in the previous section, on the DJIA and SA firms. Both test the null hypothesis that the two samples have the same stochastic distribution, versus the alternative that the distribution of the US firms are larger than that of the SA firms. From

the table, we see firstly that the DJIA firms have larger aggregate medians for all three ratios. Placing these in statistical context, the rank-sum tests suggest, firstly, that the null of equal distributions cannot be rejected for the Profit Margin ratios. For both the Return on Assets and Return on Equity ratios, we see the nulls strongly rejected in favour of the one-sided alternatives of the DJIA firms being drawn from significantly higher distribution than industrial firms in SA. When we consider only the period 2000 – 2013 in table A.6 in the appendix, we see similar results. The difference is that the one-sided WMW and WS tests now suggest that DJIA firms enjoy significantly higher Profit Margins, while the hypothesis of equal distributions cannot be rejected for the other two ratios. Also, for all the ratios we find higher aggregate medians for DJIA firms.

These tables are in clear contrast to the conclusions drawn by Fedderke et al. (2007) that SA firms are significantly more profitable than comparable US firms. This is also in contrast to the findings of Aghion et al. (2008). The latter authors' findings will be tested further in the following subsection where we compare profitability to not only firms in the US, but also the UK and Brazil.

Table 5: SA vs DJIA firms: 1980 – 2014

Profitability Ratios	P.M.	R.O.A.	R.O.E.
Highest Av. Median	US	US	US
Two-sided test	(95% confidence p-Values)		
H_a: US $\neq$ SA			
Wilcoxon-Mann-Whitney	0.728	0.007	0.193
Wilcoxon signed-rank	0.853	0.018	0.221
One Sided test	(95% confidence p-Values)		
H_a: US $>$ SA			
Wilcoxon-Mann-Whitney	0.364	0.004	0.096
Wilcoxon signed-rank	0.426	0.009	0.111
SA Aggregate Median	6.725	0.094	16.730
US Aggregate Median	7.088	5.791	19.275

5.2. Cross-Country comparison of Profitability ratios: 1994 – 2013

The comparison of the profitability of the top 25 SA industrial firms versus that of comparable US, UK and Brazilian firms, are summarized in tables A.7, A.9 and A.11, contained in the appendix, for all six ratios discussed in section 3.2. The tables show firstly that the null hypothesis of equal distributions for each of the ratios for the countries collectively, are strongly rejected by the Kruskal-Wallis tests. This motivates further testing in a bivariate setting in order to compare the ratios separately using the WMW and WS tests.

Table A.7 shows that SA firms enjoy higher aggregate Return on Assets (ROA) and Return on Equity (ROE) than comparable US firms. In contrast, US firms have significantly higher aggregate Price/Earnings (PE) ratios and Profit Margin (PM) ratios, while aggregate Gross Margins (GM) are largely equal. The non-parametric tests suggest that the null of equal distributions for ROE and ROA are rejected in favour of the alternative that SA firms have significantly higher ratio distributions, while the opposite holds for the PM, PE and PB ratios. The tests both suggest that GM have equal distributions.

Table A.9 compares SA and UK firms, with the aggregate ROE, ROA and GM ratios very similar, and the non-parametric tests unable to reject the hypothesis of equal distributions. The aggregate ratios for PM, PE and PB are significantly higher for UK firms, with the WMW and WS tests confirming the higher profitability ratio distributions for firms from the UK. In fact, for all of the latter mentioned ratios, the annual median for SA firms rarely, if ever, exceed that of its foreign counterparts on aggregate.

Table A.11 compares SA and Brazilian firms and shows that SA firms have higher aggregate ROE, ROA and PB ratios. The non-parametric tests also suggest that SA firms are signficantly more profitable based on these ratios, while Brazilian firms outperform only with respect to the GM ratio, despite also enjoying higher aggregate PM and PE ratios.

When considering only the period from 2000 onwards, we see similar results that suggest SA firms are not necessarily more profitable than their foreign counterparts (see tables A.8, A.10 and A.12 in the appendix). We see that SA firms only enjoy significantly higher distributions for the ROA measure relative to US, UK and Brazilian firms, and significantly higher ROE ratios versus Brazilian firms on aggregate. In contrast, SA firm profitability ratios are found to be drawn from a significantly lower stochastic distribution than US, UK and Brazilian firms for the PM and PE ratios, as well as for

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the PB ratios versus the US and UK, and the GM ratios versus the UK and Brazil.

In summary, the non-parametric test results suggest that for the period 1994 – 2013 and since 2000, that large South African industrial firm profitability ratios, after controlling for exchange rate depreciations and survivorship bias, are mostly significantly lower than those from comparable US, UK and Brazilian firms. This is in stark contrast to the findings of Fedderke et al. (2007) and ABF (2008) discussed earlier.

6. Conclusion

Our study aims to test the well established finding in the literature that SA firms are significantly more profitable and operate in a highly concentrated market, relative to that of their foreign counterparts. This claim has significant implications for policy makers, as this has been interpreted in the past as suggesting that SA firms charge excessive mark-ups and that the main loser would be the consumer. In testing this hypothesis, much of the literature has relied on a derived form of Bain (1951)'s SCP framework, which argues for a direct connection between profitability and market concentration, and mark-ups charged by firms. Such proponents include Fedderke et al. (2007) and Aghion et al. (2008) who found evidence of this connection and suggest that SA firms are nearly twice as profitable as US firms and other foreign counterparts. In the current study we control for exchange rate depreciation and control for survivorship bias and find no such evidence of significantly higher profitability ratios.

We do this by comparing a detailed data base of SA and US industrial firms, proxied for by the Dow Jones Industrial Average (DJIA), since 1980. In addition, we also compare a range of standard profitability ratios, calculated by Bloomberg, for the top 25 industrial firms in South Africa, the US, the UK and Brazil since 1994. The aim of this paper is thus not to provide a conclusive ranking, but rather to test the hypothesis that large industrial SA firms indeed are significantly more profitable than comparable firms in the US, UK and Brazil.

We proceed first by calculating three series of median profitability for each of the profitability ratios used for SA industrial and DJIA firms. This allows for a direct comparison of the ratios as well as enabling us to compare the stochastic distributional fits using non-parametric (Wilcoxon-Mann-Whitney, Mann-Whitney Signed-rank and Kruskal-Wallis) test procedures.

We consider the median ratios for both sets of firms by decade since 1980. In so doing, we establish that SA firms do not have consistently higher profit margins, ROEs or ROAs relative to the US DJIA for the period 1980 – 2014.

The second data set also presents evidence that SA firms are not significantly more profitable than their foreign counterparts. In fact, it seems to suggest that on most ratios the foreign firms outperform SA firms. The results do suggest similar results for SA firms relative to US, UK and Brazilian firms in terms of Gross Margin, Profit Margin and Price Earnings Ratios. However, we do find that SA firms enjoy higher Return on Assets and Return on Equity ratios than comparable firms in the US and Brazil, and higher Price-to-Book ratios than in Brazil.

In summary, our results cast doubt on the findings of Aghion et al. (2008) and Fedderke et al. (2007) and others who suggest that SA firms enjoy significantly higher profitability ratios than their foreign counterparts. Although our results are only for the largest firms in each country, we expect it to be reflective of other firms as well.

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Appendix A. Tables

Table A.6: SA vs DJIA: 2000 – 2013

Profitability Ratios	PM	ROA	ROE
Highest Avg. Median	US	US	US
Two-sided test	(95% confidence p-Values)		
H_a: US $\neq$ SA			
Wilcoxon-Mann-Whitney	0.001	0.265	0.541
Wilcoxon signed-rank	0.007	0.391	0.670
One Sided test	(95% confidence p-Values)		
H_a: US $>$ SA			
Wilcoxon-Mann-Whitney	0.001	0.132	0.270
Wilcoxon signed-rank	0.003	0.195	0.335
SA Aggregate Median	0.066	0.041	0.164
US Aggregate Median	0.094	0.063	0.185

Table A.7: SA vs US: 1994 − 2013

Profitability Ratios	ROE	ROA	PM	GM	PE	PB
Highest Avg. Median	SA	SA	US	SA	US	US
Two-sided test	(95% confidence p-Values)					
H_a: US ≠ SA						
Wilcoxon-Mann-Whitney	0.024	0.004	0.001	0.125	0.000	0.000
Wilcoxon signed-rank	0.028	0.000	0.000	0.377	0.000	0.000
Kruskal-Wallis test	0.000	0.000	0.004	0.000	0.000	0.000
One Sided test	(95% confidence p-Values)					
H_a: Highest Distribution	SA	SA	US	SA	US	US
Wilcoxon-Mann-Whitney	0.012	0.002	0.000	0.062	0.000	0.000
Wilcoxon signed-rank	0.014	0.000	0.000	0.188	0.000	0.000
SA Avg. Median	18.989	7.394	4.715	28.422	10.017	1.778
US Avg. Median	16.412	5.771	6.308	27.076	17.122	2.721
Times SA > US	75%	75%	5%	50%	0%	5%

Table A.8: SA vs US: 2000 − 2013

Profitability Ratios	ROE	ROA	PM	GM	PE	PB
Highest Avg. Median	SA	SA	US	SA	US	US
Two-sided test	(95% confidence p-Values)					
H_a: US ≠ SA						
Wilcoxon-Mann-Whitney	0.362	0.153	0.003	0.390	0.000	0.000
Wilcoxon signed-rank	0.305	0.033	0.000	0.787	0.000	0.000
Kruskal-Wallis test	0.047	0.138	0.005	0.000	0.000	0.000
One Sided test	(95% confidence p-Values)					
H_a: Highest Distribution	SA	SA	US	SA	US	US
Wilcoxon-Mann-Whitney	0.181	0.077	0.002	0.195	0.000	0.000
Wilcoxon signed-rank	0.153	0.016	0.000	0.393	0.000	0.000
SA Aggregate Median	18.872	7.593	5.182	27.752	9.938	1.758
US Aggregate Median	17.097	6.060	7.037	27.407	16.920	2.900

Table A.9: SA vs UK: 1994 − 2013

Profitability Ratios	ROE	ROA	PM	GM	PE	PB
Highest Avg. Median	SA	SA	UK	UK	UK	UK
Two-sided test	(95% confidence p-Values)					
H_a: UK ≠ SA						
Wilcoxon-Mann-Whitney	1.000	0.557	0.000	0.114	0.000	0.000
Wilcoxon signed-rank	0.917	0.520	0.000	0.092	0.000	0.000
Kruskal-Wallis test	0.000	0.000	0.004	0.000	0.000	0.000
One Sided test	(95% confidence p-Values)					
H_a: Highest Distribution	SA	SA	UK	UK	UK	UK
Wilcoxon-Mann-Whitney	0.500	0.278	0.000	0.057	0.000	0.000
Wilcoxon signed-rank	0.458	0.260	0.000	0.046	0.000	0.000
SA Avg. Median	18.989	7.394	4.715	28.422	10.017	1.778
UK Avg. Median	18.948	7.202	6.115	29.032	17.311	2.987
Times SA > UK	40%	60%	5%	20%	0%	0%

Table A.10: SA vs UK: 2000 − 2013

Profitability Ratios	ROE	ROA	PM	GM	PE	PB
Highest Avg. Median	SA	SA	UK	UK	UK	UK
Two-sided test	(95% confidence p-Values)					
H_a: UK ≠ SA						
Wilcoxon-Mann-Whitney	0.840	0.034	0.081	0.007	0.000	0.000
Wilcoxon signed-rank	0.787	0.001	0.013	0.002	0.000	0.000
Kruskal-Wallis test	0.047	0.138	0.005	0.000	0.000	0.000
One Sided test	(95% confidence p-Values)					
H_a: Highest Distribution	SA	SA	UK	UK	UK	UK
Wilcoxon-Mann-Whitney	0.420	0.017	0.041	0.004	0.000	0.000
Wilcoxon signed-rank	0.393	0.000	0.007	0.001	0.000	0.000
SA Aggregate Median	18.872	7.593	5.182	27.752	9.938	1.758
UK Aggregate Median	18.283	6.139	5.958	29.383	17.021	2.850

Table A.11: SA vs Brazil: 1994 − 2013

Profitability Ratios	ROE	ROA	PM	GM	PE	PB
Highest Avg. Median	SA	SA	BR	BR	BR	SA
Two-sided test	(95% confidence p-Values)					
H_a: BR $\neq$ SA						
Wilcoxon-Mann-Whitney	0.000	0.000	0.728	0.020	0.709	0.012
Wilcoxon signed-rank	0.000	0.000	0.777	0.052	0.300	0.003
Kruskal-Wallis test	0.000	0.000	0.004	0.000	0.000	0.000
One Sided test	(95% confidence p-Values)					
H_a: Highest Distribution	SA	SA	BR	BR	BR	SA
Wilcoxon-Mann-Whitney	0.000	0.000	0.364	0.010	0.354	0.032
Wilcoxon signed-rank	0.000	0.000	0.388	0.026	0.150	0.011
SA Avg. Median	18.989	7.394	4.715	28.422	10.017	1.778
BR Avg. Median	9.511	4.081	4.909	30.045	10.999	1.186
Times SA > Brazil	90%	95%	40%	20%	30%	70%

Table A.12: SA vs Brazil: 2000 − 2013

Profitability Ratios	ROE	ROA	PM	GM	PE	PB
Highest Avg. Median	SA	SA	BR	BR	BR	SA
Two-sided test	(95% confidence p-Values)					
H_a: BR $\neq$ SA						
Wilcoxon-Mann-Whitney	0.022	0.050	0.007	0.000	0.081	0.960
Wilcoxon signed-rank	0.002	0.002	0.008	0.000	0.003	0.787
Kruskal-Wallis test	0.047	0.138	0.005	0.000	0.000	0.000
One Sided test	(95% confidence p-Values)					
H_a: Highest Distribution	SA	SA	BR	BR	BR	SA
Wilcoxon-Mann-Whitney	0.011	0.025	0.041	0.000	0.041	0.480
Wilcoxon signed-rank	0.001	0.001	0.007	0.000	0.002	0.393
SA Aggregate Median	18.872	7.593	5.182	27.752	9.938	1.758
BR Aggregate Median	14.266	5.769	7.218	30.876	14.120	1.726

Appendix B. Firms included in the study

South African industrials in 1980-2013 data set.

1. ABERCOM GROUP LIMITED
2. ADCOCK INGRAM LIMITED
3. ADCORP
4. AECI LIMITED
5. AFRICAN CABLES LIMITED
6. AFRICAN OXYGEN LIMITED
7. ALLIED ELECTRONICS CORPORATION LIMITED
8. ALLIED TECHNOLOGIES LIMITED
9. ALPHA LIMITED
10. AMALGAMATED BEVERAGE INDUSTRIES LIMITED
11. ANGLO AMERICAN INDUSTRIAL CORPORATION LIMITED
12. ANGLO AMERICAN PROPERTIES LIMITED
13. ANGLOVAAL INDUSTRIES LIMITED
14. ASPEN PHARMACARE HOLDINGS LIMITED
15. AVENG
16. BARLOWORLD LIMITED
17. BASIL READ HOLDINGS LIMITED
18. BELL
19. BEVERAGE & CONSUMER INDUSTRY HOLDINGS LIMITED
20. BIDVEST GROUP
21. BLUE CIRCLE LIMITED

22. C G SMITH FOODS LIMITED

23. C G SMITH LIMITED

24. CADBURY SCHWEPPES (SOUTH AFRICA) LIMITED

25. CERAMIC INDUSTRIES LIMITED

26. CHARTER - STERLING

27. COMPAREX HOLDINGS LIMITED

28. CONSOL LIMITED

29. CONSOLIDATED INF

30. CORNICK GROUP LIMITED

31. DARLING AND HODGSON LIMITED

32. DATATEC LIMITED

33. DIMENSION DATA HOLDINGS PLC

34. DISTRIBUTION & W

35. DORBYL LIMITED

36. DUNLOP AFRICA LIMITED

37. EDGARS CONSOLIDATED STORES LIMITED

38. ENERGY AFRICA LIMITED

39. ENGEN LIMITED

40. EQSTRA HOLDINGS

41. EVERITE GROUP LIMITED

42. FEDERALE VOLKSBELEGGINGS BEPERK

43. FOODCORP LIMITED

44. FOSCHINI LIMITED

45. GENBEL SOUTH AFRICA LIMITED

46. GRINDROD

47. GROUP FIVE

48. HAGGIE LIMITED

49. HIGHVELD STEEL & VANADIUM CORPORATION LIMITED

50. HOWDEN AFRICA

51. HUDACO INDS. LIMITED

52. HUNT LEUCHARS & HEPBURN HOLDINGS LIMITED

53. ICS HOLDINGS LIMITED

54. IMPERIAL HOLDINGS LIMITED

55. INVICTA HOLDINGS

56. IPROP HOLDINGS LIMITED

57. JD GROUP LIMITED

58. JOHANNESBURG CONSOLIDATED INVEST CORP

59. JOHNNIC HOLDINGS LIMITED

60. KANHYM INVESTMENTS LIMITED

61. KAP INDUSTRIAL

62. KOHLER LIMITED

63. MALBAK LIMITED

64. MASSMART HOLDINGS LIMITED

65. MESSINA LIMITED (OLD)

66. METKOR GROUP LIMITED

67. MOBILE INDUSTRIES LIMITED

68. MPACT LIMITED

69. MIH HOLDINGS LIMITED

70. MITTAL STEEL S.A LTD

71. MTN GROUP LIMITED

72. MURRAY and ROBERTS HOLDINGS LIMITED

73. M-WEB HOLDINGS LTD (EX MIH/M-WEB)

74. MVELASERVE LIMITED

75. NAMPAK LIMITED

76. NASPERS LIMITED -N

77. NETWORK HEALTHCARE HOLDINGS LIMITED

78. NET 1 UEPS TECHNOLOGIES

79. NEW AFRICA INVESTMENT LIMITED

80. NEW BOND CAPITAL LIMITED

81. NEW CLICKS HOLDINGS LIMITED

82. NORTHERN ENGINEERING INDUSTRIES AFRICA LIMITED

83. OK BAZAARS (1929) LIMITED

84. PEP LIMITED

85. PEPKOR LIMITED

86. PICK 'N PAY STORES LIMITED

87. PLATE GLASS and SHATTERPRUFE INDUSTRIES LIMITED

88. POLIFIN LIMITED

89. PREMIER GROUP LIMITED OLD

90. PRETORIA PORTLAND CEMENT COMPANY LIMITED

91. PRIMEDIA LIMITED

92. PROFURN LIMITED

93. RAUBEX

94. REMBRANDT GROUP

95. REMGRO LIMITED

96. REUNERT LIMITED

97. RICHEMONT SECURITIES AG

98. ROMATEX LIMITED

99. ROTHMANS INTERNATIONAL - STERLING

100. SABMILLER PLC

101. SAFMARINE and RENNIES HOLDINGS

102. SAPPI LIMITED

103. SASOL LIMITED

104. SENTRACHEM LIMITED

105. SHOPRITE HOLDINGS LIMITED

106. STEFANUTTI

107. SOUTHERN SUN HOTEL HOLDINGS LIMITED

108. STEINHOFF INTERNATIONAL HOLDINGS LIMITED

109. SUN INTERNATIONAL (SOUTH AFRICA)

110. SUN INTERNATIONAL LIMITED

111. SUPER GROUP LIMITED

112. TECHNOLOGY SYSTEMS INTERNATIONAL LIMITED

113. TELKOM SA LIMITED

114. TIGER BRANDS LIMITED

115. TIGON LIMITED

116. TOYOTA SOUTH AFRICA LIMITED

117. TRENCOR LIMITED

118. TRUWORTHS INTERNATIONAL LIMITED

119. TWP HOLDINGS LIMITED

120. WILSON BAYLEY

121. WOOLWORTHS HOLDINGS LIMITED

DJIA companies in 1980-2013 data set.

1. 3M

2. ALCOA

3. ALTRIA GROUP

4. AMERICAN CAN (PRIMERICA CORP)

5. AMERICAN EXPRESS

6. AMERICAN INTERNATIONAL GROUP

7. AMERICAN TOBACCO (AMERICAN BRANDS INC.)

8. AT&T

9. BANK OF AMERICA

10. BETHLEHEM

11. BOEING

12. CATERPILLAR

13. CHEVRON

14. CISCO

15. CITIGROUP

16. COCA COLA

17. DU PONT EIDE NEMOURS

18. EASTMAN KODAK

19. EXXON MOBIL

20. GENERAL ELECTRIC

21. GENERAL FOODS

22. GENERAL MOTORS

23. GOLDMAN SACHS

24. GOODYEAR TIRE & RUB.

25. HEWLETT-PACKARD

26. HOME DEPOT

27. HONEYWELL INTERNATIONAL

28. INCO HOMES

29. INTEL

30. INTERNATIONAL BUSINESS MACHINES

31. INTERNATIONAL PAPER

32. JOHNS-MANVILLE

33. JOHNSON & JOHNSON

34. JP MORGAN CHASE & CO.

35. MONDELEZ

36. MCDONALDS

37. MERCK & CO.

38. MICROSOFT

39. MOTORS LIQUIDATION

40. NAVISTAR INTERNATIONAL

41. NIKE

42. PFIZER

43. PRIMERICA CORPORATION

44. PROCTER & GAMBLE

45. SBC COMMUNICATIONS INCORPORATED

46. SEARS HOLDINGS

47. TEXACO INCORPORATED

48. TRAVELERS

49. UNION CARBIDE

50. UNITED HEALTH

51. UNITED TECHNOLOGIES

52. US.STEEL

53. USX CORPORATION

54. VERIZON COMMS.

55. VISA INC.

56. WAL MART STORES

57. WALT DISNEY

58. WESTINGHOUSE ELECTRIC

59. WOOLWORTH

S.A Industrials in 1994-2013 data set.

1. REMGRO LTD
2. BIDVEST GROUP
3. IMPERIAL HOLDINGS
4. NAMPAK LTD
5. BARLOWORLD LTD
6. GRINDROD LTD
7. PPC LTD
8. TRENCOR LTD
9. KAP INDUSTRIAL
10. REUNERT LTD
11. SUPER GROUP LTD
12. MURRAY & ROBERTS
13. WILSON BAYLEY HOMES
14. INVICTA HOLDINGS
15. AVENG LTD
16. ALLIED ELE
17. MPACT LTD
18. NET 1 UEPS TECH
19. CONSOLIDATED INF
20. RAUBEX GROUP LTD
21. ADCORP HOLDINGS
22. HUDACO INDUSTRIES LTD

23. GROUP FIVE LTD

24. HOWDEN AFRICA

25. MIX TELEMATICS

26. MICROMEGA HLDGS

27. AFRIMAT LTD

28. METROFILE

29. MASTER DRILLING

30. DISTRIBUTION & W

31. ELB GROUP LTD

32. ARB HOLDINGS LTD

33. CALGRO M3 HOLDIN

34. SEPHAKU HOLDINGS

35. TORRE INDUSTRIES

36. STEFANUTTI

37. ONELOGIX GROUP

38. ILIAD AFRICA LTD

39. EQSTRA HOLDINGS

40. AUSTRO GROUP LTD

41. VALUE GROUP LTD

42. CSG HOLDINGS LTD

43. BELL EQUIPMENT

44. ASTRAPAK LTD

45. BOWLER METCALF

46. DIGICORE HOLDING

47. TRANSPACO LTD

48. BASIL READ HOLDINGGS

49. CARGO CARRIERS

50. MASONITE AFRICA

51. JASCO ELECTRONIC

52. WINHOLD LTD

53. LABAT AFRICA LTD

54. MINE RESTORATION

Appendix D: U.S Industrials in 1994-2013 data set.

1. GENERAL ELECTRIC

2. UNITED PARCEL-B

3. UNITED TECH CORP

4. 3M

5. UNION PAC CORP

6. BOEING

7. HONEYWELL INTERNATIONAL

8. DANAHER CORP

9. LOCKHEED MARTIN

10. CATERPILLAR INC

11. FEDEX CORP

12. GENERAL DYNAMICS

13. EMERSON ELEC CO

14. ILLINOIS TOOL WORKS

15. CSX CORP

16. PRECISION CASTPT

17. RAYTHEON CO

18. NORFOLK SOUTHERN

19. DEERE & CO

20. EATON CORP PLC

21. NORTHROP GRUMMAN

22. LINKEDIN CORP

23. CUMMINS INC

24. SHERWIN-WILLIAMS

25. WASTE MANAGEMENT

26. PARKER HANNIFIN

27. ALLIANCE DATA

28. TYCO INTERNATIONAL

29. FIDELITY NATIONAL

30. WW GRAINGER INC

31. INGERSOLL-RAND

32. AMPHENOL CORP

33. XEROX CORP

34. ROPER INDS

35. ROCKWELL AUTOMATIC

36. REPUBLIC SVCS

37. AGILENT TECH INC

38. KANSAS CITY SOUTH

Appendix C. U.K industrials in 1994-2013 data set.

1. ROLLS-ROYCE HOLDINGS

2. SAINT GOBAIN

3. BAE SYSTEMS PLC

4. CRH PLC

5. EXPERIAN PLC

6. WOLSELEY PLC

7. CAPITA PLC

8. BUNZL PLC

9. ASHTEAD GROUP

10. BABCOCK INTL GRP

11. TRAVIS PERKINS

12. G4S PLC

13. SMITHS GRP PLC

14. ROYAL MAIL

15. MEGGITT PLC

16. WEIR GROUP PLC

17. AGGREKO PLC

18. INTERTEK GROUP

19. COBHAM PLC

20. SMURFIT KAPPA GR

21. IMI PLC

22. REXAM PLC

23. DS SMITH PLC

24. DCC PLC

25. MELROSE INDUSTRIES

26. HALMA PLC

27. HOWDEN JOINERY GROUP

28. SPECTRIS PLC

29. RENTOKIL INITIAL

30. SPIRAX-SARCO

31. HAYS PLC

32. ESSENTRA PLC

33. ROTORK PLC

34. BERENDSEN PLC

35. REGUS PLC

36. KINGSPAN GROUP

37. BBA AVIATION PLC

38. GRAFTON GRP-UTS

39. RENISHAW PLC

Brazilian Industrials in 1994-2013 data set.

1. CCR SA
2. WEG SA
3. EMBRAER
4. KLABIN SA
5. ECORODOVIAS
6. DURATEX SA
7. ARTERIS SA
8. ALL AMERICA LATIN
9. MARCOPOLO
10. JSL SA
11. VALID SA
12. SANTOS BRAS
13. RANDON PART
14. KEPLER WEBER
15. MILLS ESTRUTURAS
16. PRUMO LOGIST SA
17. TEGMA
18. TPI
19. PORTOBELLO
20. CONTAX PART
21. MAGNESITA REFRAT
22. ETERNIT

23. LOG-IN LOGISTICA

24. EUCATEX

25. INDS ROMI

26. TEKNO SA

27. CSU CARDSYSTEM

28. MENDES JR

29. BARDELLA

30. FORJA TAURUS

31. SONDOTECNICA SA

32. BATTISTELLA

33. LIX DA CUNHA-PRF

34. TREVISA

35. NORDON MET

36. METAL IGUACU

37. BAHEMA

38. INEPAR

39. TECNOSOLO

40. RECRUSUL

41. SULTEPA

42. CHIARELLI SA

43. COBRASMA

44. CONST A LINDEN

45. FERRONORTE

46. DOC IMBITUBA

47. AZEVEDO

48. FER C ATLANT

49. RIMET

50. TREVISA INV SA

51. CONST BETER