University of Stellenbosch

Graduate School of Business

Is the Rand under valued?

A comparison to the US$

Economics Individual Assignment

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Declaration

Hereby I, Alexander Markowski, declare that this work is my own original work and that all sources have been accurately reported and acknowledged, and that this document has not previously in its entirety or in part been submitted at any university in order to obtain an academic qualification.

Bellville, 2002-10-03

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1 Introduction

1.1 Setting the scene

The foreign exchange rate is more than ever driven by the market forces of supply and demand. Both, supply and demand, are influenced by domestic interest rates and future exchange rate speculations by domestic as well as international investors. The foreign exchange rate however, toggles imports and exports, thereby indirectly influencing the inflation rate of the country. Certain studies suggest that exchange rate variability shows a lagged response to inflation - and that exchange rate regimes do not cause inflation (Quirk (1996)).

1.2 Objectives

In this document, the value of the South African Rand (ZAR) shall be investigated. This shall be done be taking the inflation differential between the South African and United States environment. By comparing the differential with the differential in the exchange rate between the South African Rand (ZAR) and the United States Dollar (USD or UD$), conclusions in terms of under or over valuation will be drawn. The method of inflation differentials will be examined as well.

By utilising the "Big Mac Index", these conclusions will be backed up with a simple index. Disagreements between the two methods will be explained as well.

1.3 Roadmap

The inflation rate as cause of changes in the foreign exchange rate is a very vague theory, based on competitiveness factors in mostly non-free floating currencies. Since the foreign exchange rate is mainly influenced by supply and demand, the inflation rate is more likely influenced by the foreign exchange rate, in the following text simply referred to as exchange rate. This is mainly due to the effect the exchange rate has on imports and exports. By using historical figures from South Africa and the United States, this whole concept will be analysed in terms of its validity.

Without going into further details of the Purchasing Power Parity (PPP), the "Big Mac Standard" - introduced by The Economist in 1984 - will be utilised in order to support the findings of the investigation on the inflation rate. Since the "Big Mac Index" utilises the price of a burger and the service around it in order to determine over and under valuation of a currency. It is a rather simple index, nevertheless, quite accurate in determining over and under valuation as well as future exchange rates.

Before any conclusions will be drawn, the "Big Mac Index" will be evaluated in terms of its usefulness. The findings drawn in this document will be utilised in order to support the arguments to this effect.

2 Inflation Differentials

2.1 CPI

The Consumer Price Index (CPI or CPI-U[1]) measures the average change in the prices urban consumers pay for a fixed market basket of goods and services. The market basket is made up of items people use in daily subsistence, and includes both items produced domestically and imported items. The relative amounts of each good or service included in the basket is based on amounts purchased by consumers during a base time period.

Year	**Average**		**Year**	**Average**	
	Index	Rate in %		Index	Rate in %
1975	6.1	–	1989	37.1	+14.5
1976	6.8	+11.5	1990	42.4	+14.3
1977	7.6	+11.8	1991	49.0	+15.6
1978	8.4	+10.5	1992	55.7	+13.7
1979	9.5	+13.1	1993	61.2	+9.9
1980	10.8	+13.7	1994	66.6	+8.8
1981	12.5	+15.7	1995	72.4	+8.7
1982	14.3	+14.4	1996	77.7	+7.3
1983	16.1	+12.6	1997	84.4	+8.6
1984	17.9	+11.1	1998	90.2	+8.6
1985	20.8	+16.2	1999	94.9	+5.2
1986	24.7	+18.8	2000	100	+5.4
1987	28.7	+16.2	2001	105.7	+5.7
1988	32.4	+12.9			

Table 2.1: Consumer Price Index for South Africa 1975-2001

Base year is 2000 (=100), Metropolitan areas, Source: Statistics SA (2002)

[1]CPI-U means all urban households, covers approximately 80% of all U.S. households

The CPI is useful when the general policy issue is the effect of price changes on the purchasing power of individuals and households. Often this index is used as a proxy for measuring the increase or decrease in the general standard of living.

2.2 PPI

The producer price index (PPI) reflects the average changes in prices that producers receive for their goods at all stages of the manufacturing process, from crude materials to finished products. The index includes the output from the goods-producing sectors: manufacturing; agriculture; forestry; fishing; mining; and gas, electricity, and waste and scrap materials. The PPI provides limited coverage of the output of the service sectors.

The PPI is useful when the general focus is on manufacturing inputs and outputs. Often the PPI is used for calculating price increases in long term sales contracts. In addition, the PPI is used as a leading indicator of future changes in the economy.

Year	**Average**		**Year**	**Average**	
	Index	Rate in %		Index	Rate in %
1975	6.9	–	1989	42.8	+15.4
1976	8.0	+15.9	1990	47.9	+11.9
1977	9.0	+12.5	1991	53.4	+11.5
1978	9.9	+10.0	1992	57.8	+8.2
1979	11.4	+15.2	1993	61.6	+6.6
1980	13.3	+16.7	1994	66.7	+8.3
1981	15.1	+13.5	1995	73.0	+9.4
1982	17.2	+13.9	1996	78.1	+7.0
1983	19.0	+10.5	1997	83.6	+7.0
1984	20.6	+8.4	1998	86.6	+3.6
1985	24.1	+17.0	1999	91.6	+5.8
1986	28.8	+19.5	2000	100	+9.2
1987	32.8	+13.9	2001	108.4	+8.4
1988	37.1	+13.1			

Table 2.2: Production Price Index for South Africa 1975-2001

Base year is 2000 (=100), Commodities for consumption, Source: Statistics SA (2002)

2.3 CPI vs. PPI

The conceptual and definitional distinctions of the PPI and CPI are consistent with the uses of these two major economic indicators. The PPI is used to deflate revenue to measure real growth in output, while the CPI is used to adjust income and expenditures for changes in the cost of living. In a nutshell, the CPI includes services, imports, and sales taxes whereas the PPI excludes them; distribution costs are included in CPI prices while PPI prices include only producers' costs; and finally, the PPI includes capital equipment while the CPI does not.

Given these restrictions, the CPI seems to be the better option when it comes to evaluating these indexes against currencies. From the figures in table 2.1 and 2.2, it becomes obvious that on the long run, CPI and PPI do not differ significantly. In the South African environment, there seems to be a small time delay between them in the earlier years.

2.4 US Inflation Data

As section 2.3 concluded to use the CPI for further comparisons, hence the equivalent data must be collected for the second currency, the United States Dollar. While Statistics SA collects the CPI for South Africa, the Federal Reserve Bank of Minneapolis tends to collect CPI-U data for the United States. Since both, the CPI and the CPI-U are more or less the same, these data will be used next to each other.

From the figures in table 2.4 on page 6 it becomes obvious, that the CPI, and therefore the inflation, are significantly higher in South Africa compared to the United States. The US data has also a chained base year. The calculation for getting back our normal 100 base-index is quite simple:

$$\frac{I_{1982} + I_{1983} + I_{1984}}{3} = \frac{96.5 + 99.6 + 103.9}{3} = 100 \tag{2.1}$$

Year	Average		Year	Average	
	Index	Rate in %		Index	Rate in %
1975	53.8	9.1	1989	124.0	4.8
1976	56.9	5.8	1990	130.7	5.4
1977	60.6	6.5	1991	136.2	4.2
1978	65.2	7.6	1992	140.3	3.0
1979	72.6	11.3	1993	144.5	3.0
1980	82.4	13.5	1994	148.2	2.6
1981	90.9	10.3	1995	152.4	2.8
1982	96.5	6.2	1996	156.9	2.9
1983	99.6	3.2	1997	160.5	2.3
1984	103.9	4.3	1998	163.0	1.6
1985	107.6	3.6	1999	166.6	2.2
1986	109.6	1.9	2000	172.2	3.4
1987	113.6	3.6	2001	177.1	2.8
1988	118.3	4.1			

Table 2.3: Consumer Price Index for the United States 1975-2001

CPI-U, Base year is chained; 1982-1984 = 100, Source: Federal Reserve Bank of Minneapolis (2002)

2.5 Exchange Rates

It requires a little bit more effort to find historical data on exchange rates, in our case between the South African Rand (ZAR) and the United States Dollar (USD or US$). By comparing the figures from table 2.4 to the figures from X-Rates.com (2002), little deviations can be found. Therefore, the data from the South African Reserve Bank (2002) will be used.

From the data in table 2.4 we can see that the Rand took quite a dip against the Dollar in the last couple of years. In fact, from 1996 to 2002, the Rand lost around 61 % in of its value in US$.

$$\frac{0.23 - 0.09}{0.23} \approx 61\% \tag{2.2}$$

By utilising figures from 1990, we can reveal a loss in value of almost 77 % to this date, showing that the devaluation against the Dollar was not that strong in the years from 1990 to 1995, but from 1996 to 2002.

	Exchange Rate		change
Year	ZAR to 1 USD	USD to 1 ZAR	from year-1
1990	ZAR 2,59	$0,39	-
1991	ZAR 2,76	$0,36	-6,69%
1992	ZAR 2,85	$0,35	-3,29%
1993	ZAR 3,27	$0,31	-14,56%
1994	ZAR 3,55	$0,28	-8,66%
1995	ZAR 3,63	$0,28	-2,18%
1996	ZAR 4,30	$0,23	-18,46%
1997	ZAR 4,61	$0,22	-7,24%
1998	ZAR 5,53	$0,18	-20,06%
1999	ZAR 6,11	$0,16	-10,51%
2000	ZAR 6,94	$0,14	-13,45%
2001	ZAR 8,60	$0,12	-24,05%
2002	ZAR 10,81	$0,09	-25,71%

Table 2.4: South African Rands to 1 USD 1990-2002

Source: South African Reserve Bank (2002), The exchange rate is the weighted average of the daily rates, figures for 2002 are based on data from January to end of September 2002.

2.6 Evaluation

Finally, all the collected figures can be utilised in order to look at the inflation differential and its impact on the exchange rate. The inflation differential theory states the following; If country A has a higher inflation rate than country B, A's currency should depreciate the amount of the differential in order to stay competitive. We saw in equation 2.2 that the Rand lost 61 % of its value in Dollar from 1996 to 2002, where it should have lost only 25 % according to the inflation differentials to stay competitive in the same time period.

Question is, if these figures – especially the exchange rate with its high fluctuation – are really helpful in the context of inflation differentials, since forces outside the reach of the reserve bank seem to determine the value of the Rand. Did the Rand become even more competitive in regards to exports? Strangely enough, the exchange rate did not follow the inflation differential at all. In fact, it depreciates more than it should be, making South Africa's goods more attractive in the world. In terms of foreign debt, this tendency seems

	FX-rate	Inflation Rate		Inflation
Year	Change	USA	SA	differential
1991	-6,69%	4,2%	15,6%	-11,4%
1992	-3,29%	3,0%	13,7%	-10,7%
1993	-14,56%	3,0%	9,9%	-6,9%
1994	-8,66%	2,6%	8,8%	-6,2%
1995	-2,18%	2,8%	8,7%	-5,9%
1996	-18,46%	2,9%	7,3%	-4,4%
1997	-7,24%	2,3%	8,6%	-6,3%
1998	-20,06%	1,6%	8,6%	-7,0%
1999	-10,51%	2,2%	5,2%	-3,0%
2000	-13,45%	3,4%	5,4%	-2,0%
2001	-24,05%	2,8%	5,7%	-2,9%

Table 2.5: Summary of Data

Source: tables 2.1, 2.4, 2.4

to be rather suicidal, since the government will need more Rands in order to repay debt in US$.

But what about the over or under valuation of the Rand? With this kind of depreciation, it is most likely that the South African currency is undervalued. From 1996 to 2002, the Rand depreciated around 36 % too much, leaving it far under valued. The next chapter (chapter 3) will look at over and under valuation in more detail.

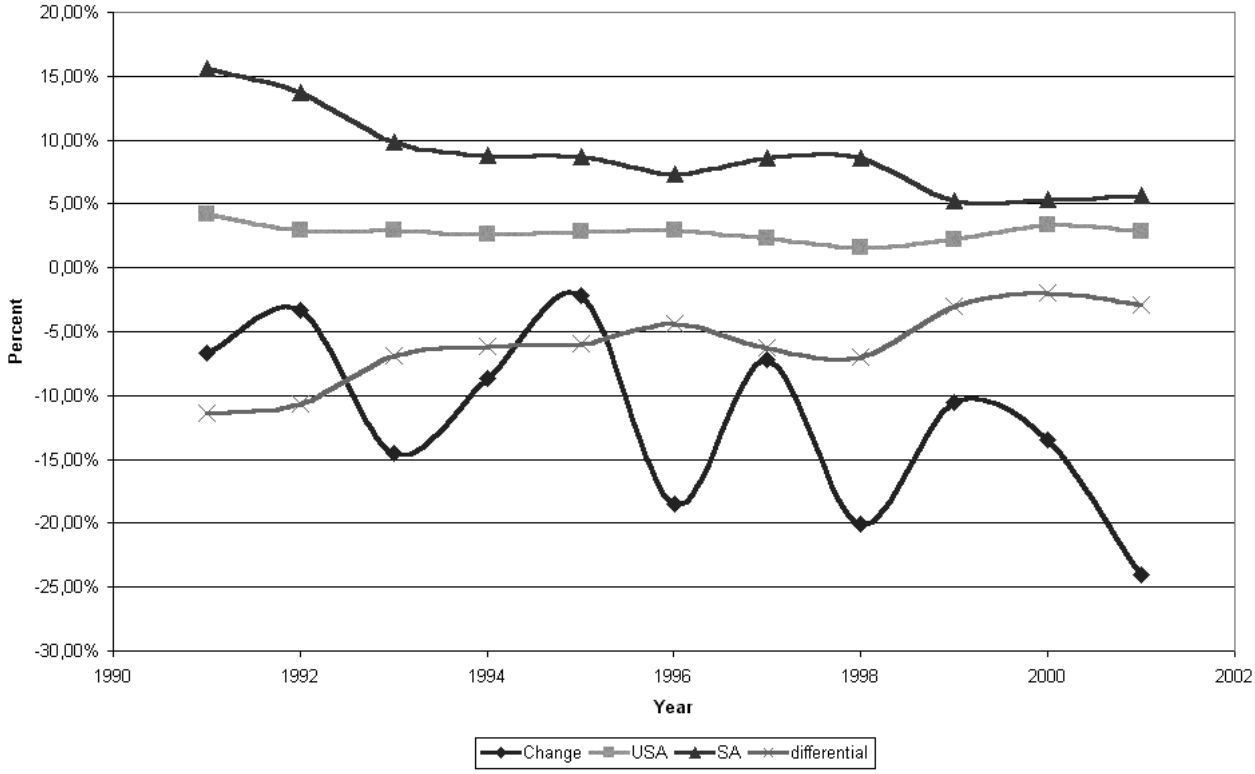

Figure 2.1: Graph on Data Summary

3 Big Mac Index

3.1 The Big Mac Standard

Purchasing Power Parity (PPP) can be defined as: "a measure of the relative purchasing power of different currencies that is measured by the price of the same goods in different countries, translated by the exchange rate of that country's currency against a "base currency" "

The most important factor of PPP conditions is that they could be useful in explaining and forecasting the long-run trend in an exchange rate, and for that reason its study is quite significant for financial analyst, international investors, companies and academia.

In 1986 The Economist released an interesting approach to quantify such effect into a very simple concept "The Big Mac Standard" in order to determine whether or not the value of a currency is over or under valued to the dollar and make some insights based on that condition

Such index is basically applied to compare country's currencies and its relative position against US dollar in order to study the differences between the prices of McDonald's Big Macs in over 110 countries. Even though the concept has had many flaws in the Asian economies because of their high devaluation policies, "the Mac Standard" has worked fairly well to determine the future development of international currencies, especially to eight large industrial economies.

Year	Big Mac Prices in ZAR	in US$	Implied PPP of the US$	ZAR to US$ exchange rate	Under(-)/Over(+) valuation vs US$
1996	7.00	1.64	2.97	4.26	-30 %
1997	7,80	1,76	3,22	4,43	-27 %
1998	8,00	1,59	3,13	5,04	-38 %
1999	8,60	1,38	3,54	6,22	-43 %
2000	9,00	1,34	3,59	6,72	-47 %
2001	9,70	1,19	3,82	8,13	-53 %
2002	9,70	0,87	3,90	10,90	-64 %

Table 3.1: South African Big Mac Index

Source: The Economist (2002)

3.2 Data

The first column of table 3.1 shows obviously the publishing year of the data for South Africa. The second column shows the local-currency prices of a Big Mac. The third converts these into dollars, using the exchange rate in column four. The average American price has fallen slightly over the past year, to $2.49. The cheapest Big Mac in 2002 is available in Argentina (78 cents), after its massive devaluation; the most expensive ($3.81) is in Switzerland. By this measure, the Argentine peso is the most undervalued currency and the Swiss franc the most overvalued.

The fifth column calculates Big Mac PPP's. Dividing the Japanese price by the American price, for instance, gives a dollar PPP of ¥105, against an actual exchange rate of ¥130. This implies that the yen is 19% undervalued in the year 2002. The € for example is only 5% undervalued relative to its Big Mac PPP, far less than many economists claim.

The euro area may have a single currency, but the price of a Big Mac varies widely, from €2.15 in Greece to €2.95 in France. However, that range has narrowed from a year ago. And prices vary just as much within America, which is why The Economist uses the average price in four cities.

The Australian dollar is the most undervalued rich-world currency in 2002, trading 35% below "McParity". No wonder the Australian economy was so strong last year. The British

pound sterling, by contrast, is one of the few currencies that is overvalued against the dollar, by 16%; it is 21% too strong against the euro.

Overall, the dollar now looks more overvalued against the average of the other big currencies than at any time in the life of the "Big Mac index". Most emerging-market currencies also look cheap against the dollar. Over half the emerging-market currencies are more than 30% undervalued. That implies that any currency close to "McParity" (eg, the Argentine peso last year, or the Mexican peso today) will be overvalued against other emerging-market rivals. Adjustment back towards PPP does not always come through a shift in exchange rates. It can also come about partly through price changes. In 1995 the yen was 100% overvalued. It has since fallen by 35%; but the price of a Japanese burger has also dropped by one-third (The Economist (2002)).

3.3 Evaluation

The "Big Mac Index" in table 3.1 on page 11 shows the Rand 64% undervalued against the dollar. In the time from 1996 to 2002, the South African currency depreciated by 30%. This 30% supports the inflation differences method in its result of 36% depreciation against the dollar from 1996 to 2002. But it seems that the Rand did not really depreciate by 36% from 1996 to 2002 like indicated by the inflation differential method.

Right at this point in time (April 2002), the Dollar seems to be a little bit overvalued himself, expectations of a depreciating Dollar have been fulfilled towards the end on 2002. This is clearly affecting emerging markets, and therefore also South Africa. The difference between the inflation differential method and the "McParity" findings might be explainable due to that.

The "Big Mac index" was originally introduced as a bit of fun. Yet it has inspired several serious studies over the past year. Ong (1995), an economist at the University of Western Australia, wrote her PhD thesis on the index. She concludes that "the Big Mac index is surprisingly accurate in tracking exchange rates over the longer term." Another study, by

Cumby (1995), also found that deviations from "McParity" are usually temporary.

But a third study, by Pakko & Pollard (1996), is more sceptical. It concludes that "the Big Mac does as well – or as poorly – at demonstrating the principles and pitfalls of PPP as more sophisticated measures."

Some people suggest replacing the "Big Mac Standard" by the 'Intel Chip Standard', in the author's eyes more than questionable. Since Intel's Pentium Processor is mainly produced in Austin, Texas, and sold worldwide to resellers from Santa Clara California, it will rather give an impression of the normal foreign exchange rate of a country. The McDonalds Big Mac is most of the time produced locally, making use of local suppliers and thereby taking into account the price of raw material in the local country.

Finding a good that is easy to transport with small or no service component is a real challenge. Since nowadays the price of a good is more often determined by marketing than by cost, this quest becomes even more challenging.

4 Conclusion

Coming back to the title of the document "Is the Rand under valued?", we can definitely say – yes. Both, the inflation differential and the "Big Mac Index" prove the South African currency to be under valued compared to the United States Dollar.

Surprisingly enough, both methods come to the conclusion, that the Rand depreciated around 45 % from 1996 to 2002. The "Big Mac Index" also tells us that in comparison to the US$, the ZAR is 64% under valued at the moment.

Applying the inflation differential method did not bring the expected result in terms of finding a relationship between the inflation rate differential and the foreign exchange rate. This might be due to a major drop in the South African exchange rate in the last six years. But even before that time, the relationship was not really visible.

The problem with the inflation differential method is, that external forces mainly influence the exchange rate. Concerns about problems arising from the land reform in Zimbabwe as well as heightened risk aversion to emerging market assets play a major role in the foreign exchange market. This goes together with the findings of the commission, employed to investigate the rapid depreciation. The commission could not link any single transaction in the foreign exchange market to the rapid depreciation in 2001.

The criticism along the "Big Mac Index" lasts, but given its simplicity, it has proven itself as a very powerful tool in order to evaluate a currency and predict its future.

What is the future for the Rand? This is very hard to tell, due to the fact, that it took major losses against the Dollar and other international currencies in the last years. This certainly helps in exporting goods and services and attracting investors as well as tourists,

but on the long run it makes critical imports like oil and technology more expensive. Even if South Africa outperformed the global economy in 2002, the rising prices for imported goods make it hard to keep the inflation down.

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