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A cost–benefit analysis for alcohol in South Africa for the year 2019

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Background: This article considers the impact of the production and consumption of alcohol on the economy of South Africa and on South Africa at large. It does this through estimating the costs of alcohol consumption for the South African (SA) society on the one hand, and comparing it to estimates of the economic benefits of having an established alcohol manufacturing industry in South Africa on the other.

Aim: The study aims to use available data to objectively assess the role of alcohol in the SA economy.

Setting: The study is conducted at a macro-level on the SA economy.

Method: Quantitative assessment of the net economic benefit (or cost) of the SA alcohol industry was used for conducting the study.

Results: The study indicates that the production of alcohol contributes significantly, both directly and indirectly, to Gross National Product (GDP) and generates broad-based employment in the economy. The damage caused by the consumption of alcohol to society is significant and primarily includes the suffering and even death resulting from medical conditions associated with the consumption of alcohol.

Conclusion: Taking all factors into consideration, the alcohol industry has a large net positive contribution to the SA economy, levels of employment, and SA society.

Contribution: There has been much debate and discussion about the net impact of the alcohol industry on South Africa. This study makes a clear contribution to the debate in that it calculates empirically, on a solid statistical foundation, a Rands and cents estimate of the net contribution of the alcohol industry to the South African economy.

Keywords: industry; alcohol; benefits; costs; evaluation.

Introduction

In this article, I will assess the impact of the legal alcohol industry on South Africa from an apolitical and objective standpoint. The article will compare the *costs* of alcohol consumption with the *benefits* of having an established alcohol industry, both with respect to consumers of alcohol in South Africa and to society at large. The article will help determine whether the costs outweigh the benefits to South African (SA) society or vice-versa.

Measuring the *benefits* and *costs* of alcohol to South African society is a difficult task. For example, the pleasures (benefits) emanating from the consumption of alcohol will be difficult to measure, as will be the costs of suffering and even death resulting from medical conditions associated with the consumption of alcohol. Notwithstanding these obvious difficulties, I will first measure the *benefits* that are more clearly accessible, namely the direct positive contributions, or *tangible benefits*, that the alcohol industry makes towards South African society. For example, the revenue generated by VAT, customs and excise duties, and alcohol production, all of which contribute to the Gross National Product (GDP).

In addition, the alcohol industry provides thousands of formal and informal jobs; both directly and indirectly – at last measure, in excess of half a million jobs. The provision of jobs constitutes an *intangible benefit*. I measure this in terms of the job losses were the alcohol industry to close down, as well as assessing the resultant rise in mortality which would result from the cessation of the income stream flowing to those (formerly) employed and their dependents. However, the most obvious form of *intangible benefit* obtained from alcohol-based drinks, is that derived by consumers in the form of their 'consumer surplus'; that is the enjoyment derived from alcohol consumption exceeds the price that consumers pay for it.

The issue facing the government is to accommodate consumer's freedom of choice, and thus allow consumers access to this intangible benefit, but to simultaneously balance this with regulatory protection for those who consume alcohol in excess and may thus inflict self-harm as well as harm on their families and third parties. Importantly, when not taken in excess, the consumption of alcohol in social settings is a mainstay of human social interaction and has been for many centuries. See, for example, Monahan and Lannutti (2000).

There has been limited published work in academic journals on the *benefits* of alcohol consumption for South Africa, but there has been much more published work on the *costs* of alcohol.

A comprehensive study commissioned by the South African Department of Trade and Industry which was authored by Truen et al. (2011) is entitled the Baseline Study of the *National Liquor Act 59, of 2003*. This study considers *both* the *benefits* and *costs* of the alcohol industry. The methodology and detail of the (alcohol) cost calculation in this report which uses the Value of Statistical Life (VSL) approach, was then carried through and published 3 years later in the *South African Medical Journal* (*SAMJ*) under the title, The Cost of Harmful Alcohol Use in South Africa. This article was published with Matzopoulos as the primary author; see Matzopoulos et al. (2014). However, this latter paper did not include any of the calculations done in the Truen et al. (2011) report (that Matzopoulos had co-authored) on the tangible and intangible *benefits* of alcohol to South Africa.

The Matzopoulos et al. (2014) paper simply replicates (with an appropriate reference) the cost results from the Truen et al. (2011) report, namely that the *tangible costs* of the alcohol industry are estimated to be R37.92bn. (for 2009) and (mid-point) *intangible costs* are estimated to be R225.39bn.

The estimate for intangible costs hinges upon the value assigned to VSL which is estimated as R3.5m. (2009 prices), closer to R6m. at 2019 prices (Note that this paper computes estimates for a multitude of different economic and costs components, all expressed in Rand values for a particular year. At the time of writing, the latest date for which all the various Rand-valued components were available, and hence the computations could be performed, was 2019), as well as estimates for the annual number of alcohol-attributed deaths. Matzopoulos et al. use a range of values for the alcohol-attributed deaths between: 36 840 (Schneider et al. 2007) and 46 153 (Rehm et al. 2009).

These tangible and intangible *costs* together (R263.31bn) constituted approximately 10.5% of GDP in 2009. In 2019 prices, these tangible and intangible cost estimates amount to more than R450 bn.

Note that the Truen et al. (2011) report does not attempt to compute a net benefit minus cost figure of the SA alcohol industry, stating that 'Because the cost and benefit assessments are conducted on a different basis and incorporate some very different variables, they cannot be netted off against each other …'. (p. viii).

On the face of it, Truen's contention that the two Rand values estimating benefits and costs respectively ' … cannot be netted off against each other …', appears disingenuous. Each of the (tangible and intangible) benefits and (tangible and intangible) costs calculated have components that are not easily converted into Rand values, and can only be approximated.

In the Truen et al. (2011) report, a Rand estimate for the proportionately large intangible cost component is added to the tangible cost component to estimate total costs. However, the intangible benefit component (consumer surplus) is not added to tangible benefits (in the form of tangible economic contribution) to estimate total economic contribution.

Truen thus misses the opportunity at the time of writing of her research (2011) to calculate a figure for the *net* economic impact of alcohol on the SA economy. Moreover, the cost component of the alcohol industry on SA society estimated in Truen's work has received considerable prominence, but the benefits, although calculated, were inexplicably ignored. Most notably in Truen's future work, for example, in her often-cited work with Matzopoulos et al. (2014) considered earlier, any figure for the Rand benefits of an alcohol industry to South Africa was excluded.

In contrast, this research aims to offer a more balanced narrative on the impact of alcohol on SA society which includes both the costs AND benefits of alcohol to SA society. As such, it would then offer a key input into the formulation of government policy in regard to alcohol management in South Africa, which balances the spectrum of societal and economic impacts of alcohol, using an objective data-based platform.

The *benefits* to South Africa from the alcohol industry

In this section, I will discuss and estimate both the *tangible* and *intangible benefits* of the alcohol industry to South Africa.

The tangible benefits of the legal alcohol industry

Introduction

The alcohol industry contributes to the economy and the social fabric of South Africa in a myriad of ways. In this section, I will summarise the tangible economic benefits of the alcohol industry as measured through the industry's contribution to GDP, tax, and employment.

The economic benefits of the alcohol industry

The alcohol industry is a significant contributor to the South African economy across a range of sectors. Some estimates in

this work are based on calculations for the *tangible benefits* from an Financial Technologies International (FTI) Consulting report which is the most up-to-date report available; see, FTI Consulting report (2020); *The Macro-economic impact of the liquor industry -including multiplier effects* (September 2020).

This FTI report computes direct, indirect, and induced Gross-Value-Added (GVA) as well as Indirect Tax and Employment impacts of the alcohol-industry on South Africa. The report uses multipliers for the sub-categories Whiskey, White spirits, Wine (cider), and Beer computed by Econex (2018).

To obtain the indirect and induced effects, FTI use a 2015 Social Accounting Matrix (SAM) based on that of Van Seventer and Davies (2019).

Note that the estimates of the beneficial impact of the alcohol industry included in the report commissioned by the Department of Trade and Industry (Truen et al. 2011) are based on the methodology used in the SABMiller (2010) report presented by Econex, as well as drawing on various Annual Company Reports, and South African Revenue Services (SARS) reports. To compute the indirect and induced benefits of the South African alcohol industry impact and hence the total beneficial impact, they also use a multiplier approach (see Truen et al. 2011:151.)

Therefore, it is worth noting that the FTI report uses the same multiplier methodology developed by Econex that was used in the earlier Truen et al. (2011) report.

The FTI analysis employs the 'input-output' (I-O) method to model the economic impact and contribution of the 'manufacturing of liquor' industry in South Africa. It measures the direct effect, indirect effect, and induced effect, the sum of which is the total economic impact. For the purposes of my analysis, I have restricted the tangible benefits to the direct and indirect effects.

Comparison of the FTI (2020) and Truen et al. (2011) figures for the tangible benefits of the alcohol sector of the South African economy

Considering the combined direct and indirect impacts to the economic contribution from Table 1, the tangible benefits of the liquor industry in 2019 equates to R141 542bn. Further, the alcohol value chain supports (directly and indirectly) 334 532 jobs and has a further induced effect on job creation of 169 066 jobs. Note that in contrast to the FTI report, Truen et al. (2011) do not separate the indirect and induced impact of the alcohol (manufacturing) sector. A summary of 2019 employment in the alcohol value chain can be seen in Table 2.

The *intangible benefits* of the alcohol industry

It is difficult to quantify all the contributions that the alcohol industry makes to the country. They include the value of personal enjoyment and social camaraderie, the role it plays in the attractiveness of the country as a tourist destination thorough its wine farms, and its contribution to economic transformation and skills development. The actual Rand value of all these *intangible benefits* is clearly difficult to estimate, and open to criticism and prone to a degree of subjectivity. However, the coronavirus disease 2019 (COVID-19) pandemic has highlighted that the consideration of livelihoods is as important as saving lives. This holds particular sway in the South African context, where a large part of the population lives below the poverty threshold, and high unemployment plays a significant role in the life expectancy of the population. See, for example, Chibba and Luiz (2011). It is within this context, that I have extended the benefits analysis to include intangible benefits through estimating the impact on 'life years gained' as a result of employment creation, with a specific focus on informal, unskilled, and low skilled employment within the alcohol value chain.

The consumer surplus of alcohol consumption

In the DNA Economics report, Truen et al. (2011) discuss the Consumer Surplus of Alcohol and note (p. 157):

TABLE 1: 2019 tangible benefits of the South African alcohol industry.

Tangible benefit category	GDP Rm. 2019 (at factor cost)	Indirect Tax† Rm. (VAT, Excise and Customs)	Total (factor cost) GDP + Indirect Tax Rm.	Employment (number of jobs)
FTI (2020)	-	-	-	-
Direct impacts	37.73	54.06	91.78	56 995
Indirect impacts	39.31	10.45	49.76	277 537
Total (direct impact + indirect impact)	77.04	64.51	141.54	334 532
Induced impacts	24.06	7.55	31.61	169 066
Total	101.10	72.051	173.15	503 598
Percentages (FTI)	2.3†	5.6‡	3.4§	
Truen et al. (2011) Rm. [at 2019 prices]	-	-	-	-
Total impact (Direct, indirect, and induced. Excise + VAT) ††	-	-	176.12	516 004¶

Note: All FTI calculations are based on the South African Social Accounting Matrix of van Seventer and Davies (2019). Indirect taxes are taxes on goods and services, that is, VAT, customs and excise taxes; they exclude companies' tax, personal income tax, as well as other smaller taxes not specified.

GDP, Gross National Product; FTI, Financial Technologies International.

†, percentage of of GDP at factor cost; ‡, percentage of total government income; §, percentage of GDP at market prices; ¶, 2009 estimates; ††, Truen et al. (2011) estimates a total impact (economic contribution) figure (including induced effects) of R93.2bn. for 2009. They do not explain it, but when computing this total, they leave out the figure for Excise tax which is listed as R10bn. I have included this figure to give a total of R103.2bn., which, when adjusted for 2019 prices amounts to R176.1bn.

TABLE 2: Summary of 2019 employment in the alcohol value chain – Direct and indirect.

Skill category	Contribution per employment category (%)	Estimated (direct + indirect) jobs per employment category
Formal: highly skilled	27.83	93 109
Formal: skilled	25.73	86 067
Formal: semi- and unskilled labour	25.03	83 725
Informal labour	21.41	71 631
Total	**100.00**	**334 532**

Source: Financial Technologies International (FTI), 2020, *FTI Consulting Report 2020*, The wine industry value chain employment breakdown, Johannesburg

A study conducted in London (by Aslam et al. 2003) estimated that consumer surplus in alcohol is approximately half again the cost of the product: in other words, 'people are willing to pay (WTP) up to 50% more than what they actually spend on alcohol'.

Truen et al. (2011) then continue:

> This provides a very rough indication of the type of value of consumer surplus in the South African market. If this estimate is then discounted to compensate for consumer irrationality, in demand for psychoactive substances, the implicit consumer surplus is then in the region of 38% of the retail purchase price. Given the estimate of the total direct value added by the liquor sector of R48.1bn. [see Table 1(Page ix)], this would imply that consumers value the pleasure derived from alcohol at R18bn. (2009 prices). However, this is an intangible value, and should not be added to the tangible economic contribution of liquor. (p. 157)

Following on from Truen et al. (2011), I will calculate the consumer surplus as an *intangible benefit* and estimate it as 38% of the total direct value added of the alcohol industry; using the direct value-added figure of R91 781m. for 2019, this would amount to an *intangible benefit* of R34 877m. (R34.88bn.) as an estimate of consumer surplus.

It is worth noting that the Truen et al. report does not add the figure estimated for consumer surplus (see above) into the Rand total for benefits (characterised as total economic contribution). For the sake of comparison, and because the value for consumer surplus is contentious, I do not include it in the final net (benefit minus cost) figure, although I do include it in the intangible benefits sum, as discussed further.

Notwithstanding these issues of how to measure the pleasure that South African society obtains from the consumption of alcohol, it remains a key part of South African culture, and clearly politicians should take account of the culture(s) in which they are operating.

The intangible benefit for South African society of Averted Job Loss

I calculated above an estimate R34.88bn., using a method suggested by Truen et al. (2011). This constitutes an estimate of the *intangible benefit* to SA consumers regarding the availability of alcohol.

There are also estimates of the job losses that would stem from a shut-down of the alcohol industry, which were estimated in total to be around 500 thousand. It is difficult to infer the Rand value impact of this job loss on livelihoods, but it is clear that the loss of income would cause a material decrease in life expectancy for those who lose their jobs, as well as for their dependents. One approach to determining this livelihood cost is to estimate the increase in mortality (referred to as excess mortality) that would result from lower employment in the case of a permanent ban of the alcohol industry in South Africa. When converted into a Rand value, this erosion of livelihoods can be regarded as an *intangible benefit* (avertable livelihood-cost) of the existence of an alcohol industry.

Deploying methods that have been used in the insurance industry and poverty studies (see Åhs and Westerling 2006), one is able to estimate the averted livelihood cost by estimating the increased mortality that would result from the job losses resulting from an alcohol industry shutdown. Although this is a difficult value to estimate, when one makes the set of conservative assumptions outlined further in the text, it yields a workable lower limit for the Rand impact on livelihoods for those who would lose their jobs in the event of an alcohol industry shutdown.

The employment impact of an alcohol-industry shutdown is divided into direct and indirect job-loss impacts. In this study, it is assumed, conservatively, that there is no livelihood impact from those job losses stemming from the induced impacts of an alcohol industry shutdown. Then using the now reduced estimates of the job loss obtained from the FTI (2020) report (based on the South African Social Accounting Matrix 2019); namely that:

Job losses Direct and Indirect = 334 532 jobs; Job losses Induced = 169 066 jobs

The 334 532 direct and indirect job losses are then split into different skill categories, using a skills breakdown from an FTI report employment report.

I will assume that in the high-skilled and skilled categories, those put out of work will get alternative employment. This means that the job loss impact is felt in the semi and unskilled (83 725) and informal (71 631) labour groups, estimated in total to be 155 356 job losses. I assume that the members of these groups do not find other employment for 10 years.

I use a dependency ratio (per employed person) calculated from the Quarterly Labour Force survey of 2.595+1 (the person themselves) = 3.595

The 155 356 semi-skilled and informal groups thus support approximately 155 356*3.595 = 558 505 individuals.

Making a conservative assumption of a 2.5% increase in mortality for the group and their dependents, because of the loss of income through job loss and using the 2016 SA Life Tables, this translates into an additional 5307 deaths per year

because of these job losses emanating from a possible alcohol-industry shutdown.

Valuing a death in South Africa using the VSL methodology (see Table 3a and Table 3b) at a value of R1m., I obtain a figure for the impact of an alcohol close-down on mortality, through the resultant job losses, at a conservative R5.31bn. (2019 prices).

I cite a value for estimated Consumer Surplus under Intangible Benefits as cited in Table 4, using the Truen et al. (2011) method, and list it in the final Table of Costs and Benefits (Table 5); but because of the uncertainty attached to the figure, I do *not* include it in the final net benefit–cost calculation.

The costs of alcohol consumption

The tangible costs of alcohol consumption

The values for the *cost* of alcohol to South African society, which are presented in the Matzopoulos et al. (2014) paper, and which estimate alcohol costs in South Africa as between 10% and 12% of GDP, have been widely cited. However, they stand in contrast to other estimates; for example, the World Health Organization has estimated the direct and indirect costs attributable to alcohol at between 1.3% and 3.3% of GDP across six developing countries in their *Global Alcohol Status Report 2011.* The paper by Matzopoulos et al. (2014) sources its cost figures directly from the Truen et al. (2011) report stating the total cost of alcohol to SA society as between R245bn. and R281 bn. at 2009 prices. However, as 80% of this total cost figure is attributed to an estimated *intangible* cost of alcohol component, this *intangible cost* estimate dominates the total cost figure.

In the further discussion I will interrogate the figure published by Matzopoulos et al. (2014) for the *intangible costs* of alcohol, in particular the Rand figure of R3.5m. used by Matzopoulos et al. (2014) for the VSL which proxies for the value to South African society of a 'death averted'. I will point out that the methodological approach used by Matzopoulos et al. (2014) is simply one of several possible methodological approaches that one might consider in order to estimate the Rand costs of an alcohol-attributed death. Moreover, I will demonstrate that the Matzopoulos methodology is fragile and that the estimates obtained by Matzopoulos are not supported by the current South African demographic profile.

Estimating the tangible costs associated with alcohol abuse

In this section, I estimate 2019-based Rand values for the tangible cost of alcohol that are realistic for the alcohol industry in South Africa. I will consider the alcohol-related tangible costs applicable to:

- road traffic accidents
- crime fighting and interpersonal violence
- incarceration and prosecution
- health-related outcomes and social development outcomes.

Alcohol-related costs associated with road traffic incidents in 2019

To estimate such a cost, one first has to estimate a cost for all road accident-related incidents that have occurred in South Africa in 2019. To compute this estimate, I have used the claims lodged with the Road Accident Fund (RAF) (2019 report); see: http://www.raf.co.za/Media-Center/Annual%20Reports/RAF%20Annual%20Report%202019.pdf

TABLE 3a: Estimates of Value of Statistical Lifeand Intangible alcohol-related costs at 2019 prices under various methodologies and assumptions - Summary table.

Author	Methodology	Year published	Income proxy per annum	Value of income proxy	VSL_{factor}	VSL estimate	Number of alcohol deaths per annum	Total Rand cost of alcohol-attributed deaths per annum
Matzopoulos et al.	$Income_{per\ Capita}$*VSL_{factor} (VSL_{factor} [Lindjem et al.])	2014	$GDP_{per\ capita}$	R85 000	73.8 (Lindjem et al.)	R6.27m.	46 153 (Rehm et al. 2009)	R289.50 bn.
Matzopoulos et al.	$Income_{per\ Capita}$*VSL_{factor} (VSL_{factor} [Lindjem et al.] + Disability Adjustment	2014	$GDP_{per\ capita}$	R85 000	73.8 (Lindjem et al.)	R8.75m. (Disability adjustment)	46 153 (Rehm et al. 2009)	R403.80 bn.
This paper	Matzopoulos-based Median income* VSL_{factor}	NA	Median income	R30 000	30	R0.900m.	46 153 (Rehm et al. 2009)	R41.53 bn.

Note: In the same way as Matzopoulos (who also gives a larger figure for VSL (when disability is included), of around 33% higher than the pure mortality-based VSL), Edoka gives a somewhat higher figure for Intangible Cost that includes "averted disability/morbidity" AS WELL AS averted deaths. Edoka does not use the term VSL explicitly and measures this cost in DALYS, arriving at a figure 17% higher for Rand Cost (than an implied-averted-death cost figure) when this (intangible) disability/morbidity is included.

VSL, value of statistical life; NA, not applicable.

TABLE 3b: Estimates of Value of Statistical Lifeand Intangible alcohol-related costs at 2019 prices under various methodologies and assumptions - Summary table.

Author	Methodology	Year published	Data period used	Elasticity estimate	VSL_{factor}	Implied VSL	Number of alcohol deaths per annum	Implied Rand cost of alcohol-attributed deaths per annum
Edoka & Stacey	Elasticity of mortality to health expenditure	2020	2002–2015	-0.223	-	R1.88m.	35 000 (estimate – 6% of mortality is alcohol attributed)	R65.80 bn.
This paper	Edoka methodology	NA	1995–2018 (weighted)	-0.416	-	R1.10m.	35 000 (estimate – 6% of mortality is alcohol attributed)	R38.82 bn.
GDI Barr et al.	Edoka methodology	2022	2005–2018	-0.916	-	R0.46m.	35 000 (estimate – 6% of mortality is alcohol attributed)	R16.23bn.

Note: In the same way as Matzopoulos (who also gives a larger figure for VSL (when disability is included), of around 33% higher than the pure mortality-based VSL), Edoka gives a somewhat higher figure for Intangible Cost that includes "averted disability/morbidity" AS WELL AS averted deaths. Edoka does not use the term VSL explicitly and measures this cost in DALYS, arriving at a figure 17% higher for Rand Cost (than an implied-averted-death cost figure) when this (intangible) disability/morbidity is included.

VSL, value of statistical life; NA, not applicable.

What constitutes an alcohol-related car accident and particularly fatal car accidents is contentious, because it is determined by the blood alcohol content (BAC) concentration of the driver and/or victim, requiring consent and South African Police Service (SAPS) involvement and paperwork. A BAC of 0.05 g/100 ml categorises the accident as alcohol-related. The Road Traffic Management Corporation (RTMC) commissioned a 2016–2018 study to positively identify an alcohol cause in 5.5% of the 13 074 fatal crashes included in the analysis (https://www.rtmc.co.za/images/rtmc/docs/research_dev_rep/Driver%20intoxication%20and%20fatal%20crashes%20Report%20-%20March_2020.pdf). However, this figure is then extrapolated to 27.1% based on a 2005 National Injury Mortality Surveillance Survey (NIMSS) report. For this analysis, the actual Rand costs in total are based on RAF claims for 2019, yielding a total cost of R98 430m. Both the figures of 5.5% (as a lower bound) and 27.1% are considered as constituting alcohol-related costs, giving figures of R5 413m and R26 670m, respectively.

Alcohol-related costs associated with crime fighting and interpersonal violence in 2019

The 2019 SAPS budget report lists a total cost of R 97 449m that can be associated with the fighting of crime in South Africa. The report lists the proportion of crimes purported to have an alcohol-related cause (ranging from 8.4% to 11.9%) (https://www.saps.gov.za/services/older_crimestats.php).

The report alludes to the fact that this figure relates to whether either the victim OR perpetrator of the crime could be attributed to an abuse of alcohol. Moreover, not all crimes result in a BAC alcohol test, which suggests that the figure could be as high as 14.7% (75% increase on the assumed 8.4%). This would lead to an alcohol-attributed crime cost between R8 815m (lower bound 8.4%) and R14 325m (upper bound 14.7%).

Costs that can be associated with alcohol-related incarceration and prosecution in 2019

A parallel approach is used in the case of the 2019 Correctional Services budgetary costs to get to alcohol-related incarceration. Using the same lower and upper bound percentages as above results in figures of R2 134m and R3 735m. A total budget cost is listed as R25 407m.

Costs for prosecution of crime (Justice and Constitutional Development budget)

The 2019 Justice and Constitutional Development Budget lists a total cost of R18 717m. Using the same percentages, as above, for alcohol-related carriage of justice costs yields figures of R1 572m and R2 751m.

Health-related costs that can be associated with an abuse of alcohol in 2019. (including social development costs)

Numerous studies have been undertaken to establish a causal link between alcohol consumption and disease. For some diseases, there is a strong association, but for others the association is tenuous and claims of a direct causality should be treated with caution.

Total cost figures for 2019 that can be associated with health care in South Africa are given from the Health Budget which lists the public health expenditure estimate as R222 400m. and the private health expenditure as R193 914m. (https://www.unicef.org/esa/sites/unicef.org.esa/files/2019-03/UNICEF-South-Africa-2019-Health-Budget-Brief.pdf). To arrive at an appropriate proportion of this total cost of R416 314m that can be attributed to an abuse of alcohol, the lower bound estimate is taken from the 2019 Global Burden of Disease report for South Africa (https://www.healthdata.org/gbd/2019) which notes that 34.54 deaths per 100 000 people in the population can be attributed to alcohol (out of an expected 938.69 deaths per 100 000 people [3.7%]).

An alternative estimate for the risk burden of alcohol of 5.6% is obtained from: *The Institute for Health Metrics and Evaluation estimates (https://www.healthdata.org/)*.

Then using the 2019–2020 Department of Social Development budget (excluding programmes unrelated to alcohol) of R41 633m. and the same percentages of alcohol-related risk burden of 3.7% and 5.6%, one may obtain figures for the alcohol-related risk burden of R1540m. and R2331m.

Aggregating the tangible cost components

In Table 4, one can aggregate all of the estimated tangible alcohol-related cost categories into a single table under a conservative (i.e. lower bound) and extreme (i.e. upper bound) scenario. It is noteworthy that the estimated tangible costs obtained here approximate those obtained by Matzopoulos et al. (2014) (when expressed in 2019 prices).

Estimating intangible costs associated with alcohol

Finding a suitable estimate for the intangible cost for alcohol-related deaths and disabilities for South Africa

The literature discusses several competing methodologies used to calculate an *intangible cost* linked to an alcohol-related death or disability in South Africa. To estimate this cost, one would first estimate the number of deaths (and/or disability) that can be attributed to an abuse of alcohol and then attempt to value (on an annual basis) the cost of these deaths (and/or disability).

Hence, one would calculate the number Disability-Adjusted-Life-Years (DALYs) that can be attributed to an abuse of alcohol, as well as the VSL. In the overview, I discussed that by far the greatest cost component that Matzopoulos et al. (2014) attribute to an abuse of alcohol constitutes an *intangible* mortality-based *cost* that has its roots in a VSL calculation.

TABLE 4: Intangible benefits of the South African alcohol industry (2019 prices).

Intangible benefit estimates	Rbn. (2019 prices)
Consumer surplus (as per Truen et al. 2011 method)	34.88
Averted livelihood impact from job losses (under an alcohol-industry shutdown)	5.31
Total	**40.19**

It is the assumptions and methodology underlying their calculation of VSL that I will address in more detail in the section that follows.

Using an estimate of Value of Statistical Life to calculate a mortality-based intangible cost

Value of Statistical Life may be viewed as the marginal rate of substitution between income and mortality. Essentially, VSL indicates how much society is WTP to reduce the risk of dying and avert a single non-specific death, which might be their own. Ideally, VSL would be estimated by group surveys to reveal society's willingness to pay for such a mortality reduction. In developing countries, such surveys are problematic and various alternative heuristics have been developed.

Matzopoulos et al. (2014) then estimate the intangible per annum-based cost for alcohol abuse in South Africa using the following formula:

Intangible Cost of Alcohol abuse (Rm) per annum
= #Estimated Alcohol Induced Deaths (per annum)
* Estimated VSL [Eqn 1]

Estimating Value of Statistical Life using per capita Gross National Product

For estimating VSL, Matzopoulos et al. (2014) then use the following heuristic equation; see, for example, Miller (2000).

$$VSL = per\ capita\ GDP * VSL_{factor} \quad [Eqn\ 2]$$

As input into the VSL equation, Matzopoulos et al. (2014) use 2009 South African per capita GDP and a VSL_{factor} multiplier of 73.8 derived from Lindhjem et al. (2011), which is deemed to be appropriate for use in South Africa, to arrive at a figure for VSL of R3.5m (2009 prices), more than R6m. at 2019 prices (see Table 3a and Table 3b). To put this figure of R6m. into some sort of context, it is edifying that at the current social grant level of R350 per month, the R6m. figure estimated by Matzopoulos et al. (2014) equates to 142 years-worth of social grant payments by the government for one person.

Matzopoulos et al. (2014) assume that between 36 840 (from Schneider et al. 2007) and 46 153 (from Rehm et al. 2009) deaths for the year 2009 can be attributed to an abuse of alcohol. These estimates for alcohol-induced deaths, along with an estimated VSL of R3.5m. and a value for VSL_{factor} of 73.8 are substituted into equations (1) and (2) yielding a cost range between R128.9bn. and R161.5bn.; finally, another 15 075 death-equivalents (seen as a death-proxy for disability, which are assumed to arise from an abuse of alcohol) equal to total VSL of R53.3bn. are added to these figures. This produces the range of 2009-based intangible costs (R183 527m. – R216 450m.) that appear in Table 5 (p. 130) of Matzopoulos et al. (2014).

The approach used by Matzopoulos et al. (2014) as expressed in equations (1) and (2) and the values of the inputs used to calculate VSL and hence the *intangible cost* may be critiqued from several points of view:

- Using a per capita based GDP figure as a proxy for what a typical South African would be earning (over a given year) is only appropriate if the population I apply it to are suitably homogenous (i.e. all lives and the risks they face are assumed to be identical with the income earning potential being evenly spread over the entire population). Given South Africa's extremely high unemployment rate and Gini coefficient as of 2019, using a per capita based GDP measure to proxy what a typical South African would be earning in a given year will radically overstate what they do in fact earn in a given year. I would argue that using a median, rather than averaged based income figure, would better proxy what a typical South African is actually earning in a given year.
- The paper by Lindhjem et al. (2011) never actually recommends an appropriate VSL_{factor} figure to use for any country in sub-Saharan Africa. For this very reason, Matzopoulos et al. (2014) compute a VSL_{factor} figure for use in South Africa by looking at the 'per capita GDP in countries with a similar purchasing power parity-adjusted per capita GDPs to that of SA'. They average VSL_{factor} for the countries China, Thailand, Chile, and Poland to arrive at a VSL_{factor} of 73.8 for use in South Africa. An obvious criticism of this method is that because VSL_{factor} is not available for any sub-Saharan country, it was necessary to use a value for VSL_{factor} which is an average across countries which are quite unlike South Africa.

Estimating Value of Statistical Life using the Edoka and Stacey (2020) method

An alternative methodology for computing VSL, which hinges exclusively on Africa is that of Edoka Stacey (2020). Using

TABLE 5: Summary of tangible costs associated with alcohol abuse (2019 Rm).

Component	Lower bound (Rm.)	Upper bound (Rm.)	Midpoint (Rm.)
Road traffic accident costs	5413	26 670	16 041
Crime prevention and interpersonal violence costs (SAPS budget)	8186	14 325	11 256
Incarceration costs (Correctional Services budget)	2134	3735	2 935
Costs for prosecution of crime (Justice and Constitutional Development budget)	1572	2751	2 162
Health related costs (Public and Private Health care spend)	15 403	23 314	19 359
Ancillary health costs (Department of Social Development Budget)	1540	2332	1936
Total	34 248	73 127	53 689
Matzopoulos et al. (2014) Tangible costs (2019 prices	-	-	6444

Note: These are 2019 based tangible costs.
SAPS, South African Police Service.

South African data, they estimate the elasticity of mortality with respect to per capita health spend (in real terms). This allows them to estimate the so-called cost-effectiveness threshold for health expenditure for South Africa, a value which reflects the efficacy of health spend for reducing mortality, disability, and suffering. In addition, this estimate of elasticity can be used to infer the Rand value that the South African government is WTP to avert the death of a South African citizen. This estimate of a *willingness-to-pay* based VSL is implied through the budgetary allocation that the South African government is prepared to make to the Health Department in order to reduce mortality and save a life: that is, the Rand amount the South African government is willing to pay to save one more South African life at the margin.

At the core of the Edoka Stacey (2020) approach is the estimation of the health spending elasticity of mortality (number of deaths) using data over the period 2002–2015. Edoka Stacey (2020) compute an elasticity estimate of –0.223 for data over the period 2002–2015, and go on to surmise that a 1% increase in health spending per capita (at 2015 prices) will avert approximately 1050 deaths and 40 055 DALYs nationally. On the basis of this elasticity estimate, Edoka Stacey (2020) then calculate the threshold for a DALY-averted at R38 500, (which was USD 3015 at the time) and the value of a death averted (VSL) as R1.472m (which was USD 115 000 at the time). In 2019 prices, Edoka's estimate of VSL is R1.88m.

In a critique of the estimates obtained by Edoka Stacey (2020), Barr (2022) pointed out that the underlying estimate of elasticity was flawed and misleading as it used data which bridged a period before (pre-2005) and after (post-2005) the implementation of anti-retroviral treatment (ART) in South Africa. The free ART programme had an extraordinary impact on mortality in South Africa as can be seen from a graph of mortality over the period 1990–2017; see Barr (2022) which plots human immunodeficiency virus (HIV) deaths and prevalence over that period. The response of Edoka Stacey (2022) to the Barr (2022), critique did not directly address the issue of the impact of ART on South African mortality. They agreed with the Barr (2022) conclusions and elasticity estimates for South African national level data, but then claimed, without explanation, that such a mortality elasticity of health expenditure for South Africa is invalid as the analysis needs to be approached from a *provincial* level with provincial level data.

Table 3a and Table 3b provides a summary of the intangible costs of alcohol mortality and morbidity estimated using the various methodologies discussed earlier for 2019 prices.

Important conclusions that can be drawn from the Table 3

A wide range of *intangible cost* estimates can be generated depending on the methodology one uses. The VSL methodology used by Matzopoulos et al. (2014) is constrained by several assumptions as discussed earlier and, in particular, it is my view that the assumptions and inputs underlying its proper use are not being met for calculations in a South African context. In contrast, I believe that the Edoka and Stacey (2020) methodology, based on a *willingness to pay* approach of the South African government is appropriate in principle. I therefore provide alternative estimates of the elasticity and VSL using this Edoka and Stacey (2020) methodology, but with data inputs that are more appropriate to the South African context. The Edoka study provides estimates of intangible costs which are lower than those Matzopoulos provides, but which, as mentioned earlier, are still inaccurate. This issue is discussed at length in Barr (2022).

The most important conclusion to draw from this section is that there is no objectively correct method, and no objectively correct set of inputs for calculating VSL. The estimate of VSL obtained will vary depending on which set of data are used, and which approach is taken. I have therefore considered a range of approaches and a range of inputs for each approach. This gives rise to a range of possible values for VSL and a range of Rand-based costs associated with the mortality (and morbidity) effects of alcohol on society. One can then consider the range of values obtained, and discuss which value, or average value, might be used as an input for policy decisions. On the basis of the VSL value obtained (at 2019 prices) using the different methods, I concluded that a median income, and VSL_{factor} of 30,[1] input into the VSL equation, as used by Matzopoulos, of GDP per Capita*VSL_{factor} gave rise to a feasible VSL of R0.9m. approach.

I believe the most appropriate point estimate for VSL for the Edoka approach was that using the elasticity estimate of –0.916 calculated by Barr (2022), is R0.46m.; however, if one is to be conservative, the elasticity estimate of –0.416 which uses a wider range of weighted data may also be deemed to be appropriate, yielding a VSL estimate of R1.1m. I surmise that the Matzopoulos approach estimate of VSL with the median income, and the two Edoka methodology estimates discussed earlier, produce reasonable, even conservative, estimates of VSL. I therefore decided to settle on a value for VSL of R1m. (2019 prices) for the purpose of this study. Therefore, when I bring the cost and benefit sides of the alcohol pricing equation together further in the text, I will be using a VSL figure of R1m. (2019 prices) to calculate intangible costs.

Overall results and conclusions

Overall tangible costs versus tangible benefits

The least contentious comparison between the costs and benefits of the alcohol industry will always be between the *tangible benefits* and *tangible costs* of the alcohol industry as these components constitute the most accurately measurable components. In Table 6, I give values at 2019 prices for the median tangible benefits and costs derived in above. Note that the tangible benefits are expressed in Rand terms but also include job creation which is given no Rand value. Note also that the total economic impact is derived from the sum of the direct effect, indirect effect, and induced effect.

1. Assuming that the average number years lost following an alcohol-induced-death is around 25 years, and that this figure is then raised to 30 to incorporate the effect of morbidities such as disability and family trauma, I arrive at a VSL_{factor} of 30, which includes both death and disability.

TABLE 6: A comparison of this report's 2019-based Tangible Costs with Tangible Benefits for the SA Alcohol Industry on a Rand (2019 prices) per annum basis, with those of Truen et al. (2011).

Variable	This article		Truen et al. (2011)	
	Rand bn. per annum, 2019 prices	Number of Jobs supported	Rand bn. per annum, 2019 prices	Number of Jobs supported
Costs				
Tangible costs	53.69	-	64.78§	-
Benefits				
Tangible benefits	173.15†	503 598‡	176.12¶	516 004
Tangible benefits excluding induced impacts	*Alt.* 141.54†	-	-	-

Indirect taxes. This value is used in the final Table (conservative).

†, FTI report. Estimate for total of direct, Indirect and Induced impacts on GDP (Factor Cost) & Indirect taxes; FTI report. Estimate for total of direct and Indirect impacts on GDP (Factor Cost); ‡, FTI report. Estimate of jobs supported in the alcohol value chain (directly and indirectly) 334 532 jobs and has a further induced effect on job creation of 169 066 jobs, giving a total of 503 598 jobs (median estimate); §, The cost section of which was reproduced as Matzopoulos et al. (2014); ¶, Note that for the Truen et al. (2011) figure, excise tax (given as R10bn. in 2009) has been added back to tangible benefits.

However, for the purposes of our analysis, I have restricted the tangible benefits to the direct and indirect effects, and this is the figure listed in Table 6.

For the sake of comparison, I also give the tangible benefit and cost values listed by Truen et al. (2011) for the SA alcohol industry, valued here at 2019 prices.

The key conclusions to draw from Table 6 are:

- The similarity in the estimated tangible benefits by FTI (173.2 bn.) and the (price adjusted) Truen et al. (2011) figure for tangible benefits of R176.1 bn.
- The similarity in the estimated tangible costs in this report (53.7 bn.) and the (price adjusted) Truen et al. (2011) figure for tangible costs of R64.7 bn (Matzopoulos et al. 2014).
- The similarity in the estimated number of jobs supported in this report (503598) and the Truen et al. (2011) figure of 516004.

It is thus clear that before intangible costs and benefits are included, the estimated values for tangible benefits far outweigh the figures for tangible costs, from BOTH of the two different sources. As the figure calculated in Table 6 uses more recent data and the methodology has been made explicit, the Table 6 figure appears apposite.

Overall total costs versus total benefits (tangible & intangible)

One can now construct Table 7 which also includes estimated *intangible costs* and estimated *intangible benefits*. As discussed earlier, in the 'indirect benefits' under 'intangible benefits', a Rand figure for Consumer Surplus is included in this table (as per the Truen et al. 2011 heuristic) but not used in the calculation of the final net figure.

Discussion and concluding remarks

Results

My 2019-based estimate of the *tangible benefit* of the alcohol industry in South Africa is R141.5bn, whereas my estimated Rand value of the *intangible benefit* (job-loss impact) to South African society is between R5.31bn. and R31.4bn., depending on my assumptions for the mortality impact, through job losses, of a legal alcohol-industry close-down. In calculating my *net impact* figure, I used the lower and more conservative figure of R5.31bn. so (if anything) to under-estimate the total benefit of the alcohol industry. My best estimate of the total benefit of the alcohol industry (using a conservative intangible benefit) at 2019 prices is thus:

R141.54bn. + R5.31bn. = R146.85bn. [Eqn 3]

The *tangible cost* impact of alcohol on society, due primarily to health, motor-accidents, and alcohol-related crime, I estimated as between R34.2bn. and R73.1bn., depending on which of the lower (3.7%) and higher (5.6%) percentage estimates of deaths that are alcohol-attributable is seen as having the most validity. The tangible cost estimate I use here is the midrange of these two estimates, namely:

(½)*(R34.23bn. + R73.16bn.) = R53.69bn. [Eqn 4]

To calculate the *intangible cost* impact of alcohol on society, I used three different methodologies with various assumptions to interrogate an appropriate estimate for the Rand value of the lives lost, because of alcohol, in a South African societal context. These values ranged between R16.23bn. for the health elasticity of mortality approach (assumption of 35000 deaths) up to R41.53bn. when using a Matzopoulos-type methodology and an assumption of 46153 deaths.

I emphasise that estimating the value of a life in the South African context is highly contentious and debatable. In order to settle on a particular Rand value, I have used here a (total) value of the Rand value alcohol-attributable lives lost per annum in the South African context of R31.15bn. at 2019 prices. This equates to a value per life on average (across all ages) of R1m. a factor of 8 to 9 times lower than the figure of Matzopoulos et al. (2014); therefore, my estimate of the total cost of alcohol to SA society is:

R53.69bn. + R31.13bn. = R84.84bn. [Eqn 5]

By offsetting the total benefits calculated with the total costs, I arrive at a *net* benefit figure for the alcohol industry to South Africa of:

R146.85bn. – R84.84bn. = R62.01bn. [Eqn 6]

TABLE 7: A summary of the benefits, costs, and the NET value of the alcohol industry.

Variable	Alternative view Rbn. at 2019 prices (Rand per annum)	Number of Jobs supported	Truen et al. (2011) Rbn. at 2019 prices
Costs			
Tangible costs	53.69*	-	64.78‡
Intangible costs	31.15†	-	289.53§
Total costs	84.84	-	-
Benefits			
Tangible benefits	141.54 (excludes induced impacts)	503 598	176.12¶ (includes induced impacts)
Intangible benefits	-	-	-
1. Averted job loss	5.31††	-	-
2. Consumer surplus (as per Truen et al. 2011)	34.88‡‡	-	-
Total benefits	146.85	-	-
Net (Benefit – Costs)	62.01	503 598	Not comparable

*, Using the median estimate.

†, Using the high estimate (5.6% alcohol-attributed mortality [31 153]) and a VSL of **R1m.** per alcohol-attributed death; ‡, Matzopoulos quotes a figure of R37 920m. for 2009. Using the GDP deflator adjustment, this equals R 64.78bn. at 2019 prices; §, Truen et al. (2011) along with Matzopoulos et al. (2014) use an alcohol-attributed death figure attributed to Rehm et al. (2009) of **46 153**, and a VSL of **R6.27m.** per alcohol-attributed death to obtain this figure; ¶, Truen et al. (2011) only gives a figure for the total of direct, indirect, and induced impacts on GDP (factor cost) & indirect taxes; ††, Using the low estimate (10-year alcohol ban); ‡‡, Not included in total benefit sum because of the uncertainty attached to this figure.

In contrast, Matzopolous et al. have focused on the *cost* figure exclusively and omitted to calculate the *benefit* side of the alcohol value equation. Moreover, their cost figure is dominated by a large, and what I believe, totally unrealistic figure for the intangible cost of alcohol to South African society.

Matzopoulos et al. (2014) do not interrogate benefits but derive a similar set of *tangible cost* figures to ours, namely R64.78bn. compared to our derived figure of R53.69bn. for *Tangible Costs*.

Critically, however, for the case of *Intangible Costs*, Matzopoulos et al. (2014) derive an inflated figure which, at 2019 prices, translates to R289.53bn. which is almost 10 times larger than our Alternative View figure of R31.15bn. at 2019 prices, reported earlier in Table 7.

The difference between these figures is related to two key factors. Firstly, that Matzopoulos et al. (2014) assume a figure of 46 153 for alcohol-attributed deaths, while our alternative view uses a figure of 31 153 for alcohol-attributed deaths. Secondly, that Matzopoulos et al. (2014) use a VSL of R6.27m. in their calculations, compared to the more realistic VSL figure of R1m. that I use in our alternative view calculations.

Final statement

While accepting that the irresponsible use of alcohol causes damage to South African society, I still believe that the value of the alcohol industry, overall, to the South African economy and society has to be seen in a *benefit minus cost context*. The figure I computed is that the alcohol industry makes a net contribution to South African society of R62.01bn. per year (at 2019 prices) which I believe is realistic and defensible, and it is this net figure which should inform government policies going forward regarding the alcohol industry. It is of note that after the COVID-19 pandemic struck South Africa in 2020, the government implemented harsh restrictions on the consumption of alcohol. These measures had severe consequences for the SA alcohol manufacturing industry and this sector is only fully recovering in 2024. If the extent of the economic impact of the alcohol restrictions implemented by the government had been known at the time, it could well have influenced, even ameliorated, the restrictive measures that the government put in place at the time.

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Competing interests

The author has declared that no competing interest exists.

Author's contributions

G.B. is the sole author of this research article.

Ethical considerations

The Ethical Considerations Statement is provided by the UCT Faculty of Science Ethics committee chaired by Prof. M. Densmore (No approval required).

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Data availability

The data that supports the finding of this study is available from the corresponding author, G.B., upon reasonable reasonable request.

Disclaimer

The views and opinions expressed in this article are those of the author and do not necessarily reflect the official policy or position of any affiliated agency of the author.

References

Åhs, A.M. & Westerling, R., 2006, 'Mortality in relation to employment status during different levels of unemployment', *Scandinavian Journal of Public Health* 34(2), 159–167. https://doi.org/10.1080/14034940510032374

Aslam, S., Barham, L., Bramley-Harker, E., Dodgeson, J. & Spackman, M., 2003, *Alcohol in London: A cost-benefit analysis,* A report for the Greater London Authority by NERA, London.

Barr, G., 2022, 'Estimating a cost effectiveness threshold for health care decision making in South Africa – A commentary', *Health Policy and Planning* 37(8), 1070–1073. https://doi.org/10.1093/heapol/czac026

Chibba, M. & Luiz, J.M., 2011, 'Poverty, inequality and unemployment in South Africa: Context, issues and the way forward', *Economic Papers* 30(3), 307–315. https://doi.org/10.1111/j.1759-3441.2011.00129.x

Econex, 2018, *Research note SA liquor industry economic multipliers – Tax, GVA, employment: Cider, spirits and beer*, Econex, Johannesburg.

Edoka, I.P. & Stacey, N., 2020, 'Estimating a cost effectiveness threshold for health care decision making in South Africa', *Health Policy and Planning* 35(5), 546–555. https://doi.org/10.1093/heapol/czz152

Edoka, I.P. & Stacey, N.K., 2022, 'Response to a commentary by Barr (2022) on Edoka and Stacey (2020) Estimating a cost-effectiveness threshold for healthcare decision-making in South Africa', *Health Policy and Planning* 37(8), 1070–1073. https://doi.org/10.1093/heapol/czac049

Financial Technologies International (FTI), 2020, *FTI Consulting Report 2020*, The wine industry value chain employment breakdown, Johannesburg.

Global Alcohol Status Report 2011, viewed 26 November 2022, from https://www.who.int/substance_abuse/publications/global_alcohol_report/msbgsruprofiles.pdf.

Lindhjem, H., Nazrud, S., Braathen, N.A. & Blausque, V., 2011, 'Valuing mortality risk reduction from environmental, transport and health policies: A global meta-analysis of stated preference studies', *Risk Analysis* 31(9), 1381–1407. https://doi.org/10.1111/j.1539-6924.2011.01694.x

Matzopoulos, R.G., Truen, S., Bowman, B. & Corrigall, J., 2014, 'The cost of harmful alcohol use in South Africa', *South African Medical Journal* 104(2), 127–132. https://doi.org/10.7196/samj.7644

Miller, T.R., 2000, 'Variations between countries in values of statistical life', *Journal of Transport, Economics and Policy* 34(2), 169–188.

Monahan, J.L. & Lannutti, P.J., 2000, 'Alcohol as social lubricant: Alcohol Myopia theory, social self-esteem, and social interaction', *Human Communication Research* 26(2), 175–202. https://doi.org/10.1111/j.1468-2958.2000.tb00755.x

Rehm, J., Kehoe, T., Rehm, M. & Patra, J., 2009, *Alcohol consumption and related harm in WHO Africa region in 2004*, Centre for Addiction and Mental Health, Toronto.

SABMiller, 2010, *Working for South Africa. The contribution of SAB to the South African economy*, Study conducted by Econex and Quantec Research for the South African Breweries Ltd.

Schneider, M., Norman, R., Parry, C., Bradshaw, D. & Plüddemann, A., 2007, 'Estimating the burden of disease attributable to alcohol use in South Africa in 2000', *South African Medical Journal* 97(8), 664–672.

Truen, S., Ramkolowan, Y., Corrigall, J. & Matzopolous, R., 2011, *Baseline study of the national liquor ACT59 of 2003*, Department of Trade and Industry, DNA Economics, Pretoria.

Van Seventer, D. & Davies, R., 2019, *A 2016 Social Accounting Matrix for South Africa with an occupationally disaggregated Labour market representation*, WIDER Working paper series WP-2019-56, World Institute for Development Economic Research (UNU-WIDER), UNU-Wider, New York.