

Past and Present Subjective Wellbeing: The Role of Contrast and Memory

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Abstract

This study is an attempt to analyse the interrelationships between current, past and expected future subjective wellbeing (SWB) through the intermediating role of memory using the National Income Dynamics Study panel dataset for South Africa. The contribution of this study is in exploring the role of contrast (inter-temporal and social) in determining; a) the current levels of SWB and, b) the drivers of recall bias; within a causal framework in the context of a country with low average SWB and high SWB inequality. The results indicate significant presence of hedonic adaptation and reveals past and future contrast as important correlates of current subjective wellbeing. In addition, a perceived improvement in current happiness from the past, is associated with higher levels of current SWB, highlighting the intermediating role of memory. Memory, however, is observed to be biased with only 42% accuracy. Higher levels of current subjective wellbeing are found to enhance the probability of correct recall of past. An overall improvement bias is evident among those in the lower segment of the SWB distribution. The results reinforce the hypothesized simultaneous relationships between current SWB, inter-temporal contrast, and recall behaviour. Further the differences in our findings from European studies emphasise the relevance of context in driving these relationships.

1. Introduction

The concept of subjective wellbeing (SWB) broadly refers to the level of life satisfaction in general that individuals self-report. According to Tatarkiewicz (1966), present level of SWB is both retrospective and prospective. Therefore, SWB of an individual is expected to straddle over the lifespan of the individual (Gomez et al 2013). One mechanism for this is through the confounding factor of individual personality. As the hedonic theory suggests the inherent personality traits remain stable over the lifespan of an individual (Gutiérrez 2005; Brickman & Campbell 1971).

The most commonly cited explanation for the hedonic treadmill is adaptation level theory which consists of two effects namely; contrast and habituation (Brickman, Coates & Bulman 1978). A contrast effect is when the quality (positive or negative) of an experience is dependent on its relation to a previous reference point (Tversky & Griffin, 1991; Griffin & Gonzalez, 2013). This highlights that happiness is also partially derived from being able to recall the memory of the major event. Memory is therefore an important conduit that links past and present satisfaction. As SWB is largely dependent on the individual's current satisfaction relative to their previous satisfaction, it would seem that the ability to accurately recall their circumstances related to their past satisfaction (through memory), is important for formulating current satisfaction.

Much of the literature assumes that people are able to access information regarding their long-term subjective well-being which is stored in their memory (Pavot & Diener, 1993). However, attempts to understand how the past influence the determination of current life satisfaction, through the intermediating role of memory; have pointed to bias in memory recall (Kahneman 1993; Adler 2013; Easterlin; Prati & Senik 2020; Kaiser 2020).

Kahneman et al (1993) highlights the memory biases through their peak-end theory which argues that memory is crafted by the most intense moments and the way an experience ends, rather than the average (or sum) of the entire experience. Another type of bias in the assessment of recalled well-being, is the influence of the current situation of the individual (Easterlin 2001). As people adapt to a new situation, they re-evaluate their view of the past in the light of their new benchmark (current situation). Therefore, a retrospective evaluation is likely to be distorted by the current situation and not entirely determined by the lived moments in the past.

In a similar vein, Adler (2013) pointed to the bias arising from heterogeneity in intrapersonal preference over time which can cloud effective comparison of individual wellbeing over time. Kaiser (2020), also emphasized that memories itself could be biased due to objective differences in the past and present circumstances, mood congruency, expectation or anticipation effect.

Prati & Senik (2020) is a recent empirical study that has explored the interdependence of past and present SWB. Prior to that, the empirical attention on past satisfaction was limited either within the context of hedonic adaptation literature (Clark, 1999; Wilson and Ross, 2000; Van Praag and Ferrer-i Carbonell, 2004; Senik, 2009; Steffel and Oppenheimer, 2009), or testing of reliability of life satisfaction measurement (Atkinson, 1982; Michalos and Kahlke, 2010). Prati and Senik (2020) found through a study of three national surveys across Britain, Germany and France that on average, people tend to overstate the improvement in their well-being over time and to understate their past happiness. But the study also finds asymmetry in perception; while happy people perceive the improvement over time to be better than it was, unhappy ones tend to exaggerate its worsening. The authors conclude that feeling happy today implies feeling better than yesterday.

The implications of emotion on memory however can differ significantly between positive and negative experiences. Similar bias in memory is highlighted by studies that show that relatively unhappy people exhibit somewhat conflicting memorial tendencies vis-à-vis happiness, whereas very happy people show simpler, and less conflicting, tendencies (Liberman et al 2009; Sharot & Yonelinas 2008). On the other hand, other studies find that negative emotion can enhance memory recall (Kensinger 2007, Alexander et al. 2005; Foa et al. 1989, Ochsner 2000). Through an experiment on Russian students, Balatsky & Diener (1993) showed that during predominantly high dissatisfaction levels, the mean recall of positive events was greater than the mean recall for negative events.

The above review of the relationship between memory recall and present SWB brings out the interdependence between the two. While the memory of the past may be contaminated by the present situation, the present SWB is also influenced by the memory of past. Empirical literature reviewed above have addressed either of the simultaneous relationships, while ignoring the other, potentially creating biased estimates. Therefore, this study makes a contribution to literature by delving into the relationship between past and present satisfaction, through the conduit of memory, while accounting for the endogenous relationship. Lewbel's heteroscedasticity based instrumental regression is used to estimate the endogenous relationship between SWB level and recall of past SWB level. This study further improves

on Prati and Senik (2020) by considering the additional element of future expectations in driving recall behaviour, based on the contention in literature (Tatarkiewicz 1966; Gomez et al 2013) that present level of SWB is both retrospective and prospective. Lastly, undertaking the analysis within the context of South Africa (a developing country ranking 106 in Happiness index (Helliwell et al 2019)) provides additional insights from other recent studies focused on developed countries with higher average satisfaction levels (like Kaiser 2020; Prati and Senik 2020).

The proposed research will attempt to answer the following questions in the context of a country with low average satisfaction:

1. Is past and future SWB related to present subjective wellbeing?
2. How does intertemporal (past and future expectations) contrast and contemporary social contrast associate with current SWB?
3. How accurate is recall of past subjective well-being?
4. What are the correlates of bias in recalled subjective well-being?

These are fascinating questions that have been raised in psychology literature within the context of developed countries with high average levels of satisfaction, but less so within the context of a developing country with lower average satisfaction level. The context of study is relevant as Prati & Senik (2020) argues that the nature of bias is dependent on the level of satisfaction, which are vary significantly across countries of different developmental status. Based on this premise, overestimation bias is likely to dominate for societies with high satisfaction level (as developed countries), as happy people tend to overstate the time improvement in their life satisfaction. This would imply that in a society with low satisfaction, underestimation bias is likely to dominate as unhappy people tend to overstate the decline in their life satisfaction. However, average SWB level has been increasing and SWB inequality declining in South Africa in recent years, indicating that less happy people have been experiencing improved SWB. Future expectations therefore are likely to play a key role and, overestimation bias from less happy individuals is a possible outcome. The South African context with low but increasing average level of satisfaction, and declining SWB inequality gives an ideal context to test this premise.

2. Data

In order to measure recall accuracy, panel data is required to compare the reported SWB of each person over at least two points in time, and compare it with recalled memory of the past at the latter time point. The National Income Dynamic Study (NIDS) data is perhaps the only available panel data sets in South Africa that has sufficient information regarding subjective well-being and questions that can be used to derive recall accuracy.

NIDS is a South African panel data study that has collected household survey data across the country for the same households, approximately in two year intervals across 5 waves (2008, 2010, 2012, 2014, 2017). Wave 1 contains data for more than 28,000 individuals over 7,300 households which make up the initial nationally-representative sample. The aim of NIDS is to collect information which can be used to

analyze issues such as poverty, employment, education, and health in the South African context. Interviews are conducted in person and proxy questionnaires are answered by a secondary member if the main member of the household is not available at the time of the interview. NIDS only interviews private households across South Africa, thereby excluding people who live in hostels, old age homes, hospitals, prisons or military accommodations, from the sample.

Most studies on SWB are based on the assumption of interpersonal and intertemporal comparability of wellbeing responses. Kaiser (2020) calls this the assumption of 'common scale use' and explains that the sources of the heterogeneity may be due to a shift in reference distributions arising from altered intrapersonal or /and interpersonal comparisons. Intrapersonal comparisons can get altered due to revised expectations and aspirations, impacting the benchmark for the evaluation of life satisfaction. Also, the comparison group of the respondents itself may change according to current satisfaction level endogenously (Falk & Knell 2004). This has a subduing impact of altered circumstances on SWB (Wilson & Gilbert 2005).

Violation of the assumption of common scale use can bias the estimated effects of explanatory variable. The empirical results from Kaiser (2020) indicates that although, in principle, the violation of *common scale use* assumption could lead to sign reversals of coefficient estimates, in practice, it is unlikely and results in downward bias in the coefficient estimates. This study therefore proceeds with this caution.

For the purpose of this research, subjective wellbeing data is acquired from the adult questionnaires for wave 1 (2008), wave 2 (2010), wave 3 (2012), wave (2014) and wave 5 (2017). SWB or life satisfaction is measured using the question M5, "*M5: Using a scale of 1 to 10 where 1 means 'very dissatisfied' and 10 mean 'very satisfied,' how do you feel about your life as a whole right now?*". Inter-temporal contrast is obtained through self reported change and observed change.

Self-reported change is obtained from question M6 from the adult questionnaire in wave 5 (2017), "*M6: Are you happier, the same or less happy with life than you were 10 years ago?*". While the language of questions M5 and M6 are not the same, to conduct this analysis, we make the assumption that question M6 can be synonymously interpreted as, "*Are you more satisfied, the same or less satisfied with life as a whole right now, than you were 10 years ago?*" to make questions M5 and M6 comparable. This is a necessary assumption because in subjective well-being literature, happiness (affect) and life satisfaction are distinct components of subjective well-being. Given that M5 refers to satisfaction as "*as a whole right now*" and M6 refers to "*happy with life,*" it is a reasonable assumption that both questions refer to satisfaction as a whole rather than the current emotional state. Further, the two questions immediately follow one another in the NIDS questionnaire reinforcing the argument that the respondent's understanding of the two are likely to be related.

Observed actual change in SWB over the ten-year period is calculated as the difference between M5 question in wave 5 and wave 1. Positive differences are categories as more satisfied, zero difference as same, and negative difference as less satisfied. Recall accuracy is obtained comparing the self-reported change with actual observed change.

Social contrast is provided by the question (M3) *“Please imagine a six-step ladder, where the poorest people in South Africa stand on the bottom (the first step) and the richest stand on the highest step (the sixth step).”* Current social contrast is provided by the follow-up question M3.2 *“On which step are you today?”*. Future expectation is provided by M3.3 *“On which step do you expect to be 2 years from now?”*. Detailed definition of the other variables used in the analysis are provided in Table A1.

For any panel data set, the problem of attrition always needs to be addressed. While attrition is inevitable, it is more important that the attrition is non-random so that the sample will not become biased and not representative of the entire population. Brophy et al. (2018) show that attrition is relatively consistent across all NIDS waves. However, they also show for example, that attrition rates are highest for White and Asian individuals, which may lead to a bias sample. To deal with the issue of attrition bias, the proposed research will use the NIDS panel weights which account for this bias and ensure that the sample remains representative of the whole population. Top up is deleted as data for first wave is not available.

3. Descriptive Statistics

The average level of life satisfaction is low in South Africa but Table 1 notes an increase in the life satisfaction over the ten-year period from an average of 5.05 (on a scale 1 to 10) over the first four waves to 5.56 in wave 5 (Table 1). The level of correct recall of life satisfaction contrast over the ten-year period is just over 42%. The black African population is over 80 percent in our sample in keeping with the South African demographics. Over 40% of our sample constitutes household heads. South Africa is a religious society with almost 90% of the individuals in the sample indicating religion to be important in their life. Further, the very high level of economic inequality in South African society is represented through the extraordinarily high standard deviation of household income variable.

Table 1
Descriptive statistics of key variables

Variable	Mean	Std. Dev.	Min	Max
Correct recall	0.42	0.488	0	1
SWB (wave 5)	5.564	2.464	1	10
Average Past SWB	5.056	1.481	1	10
Observed SWB difference@	2.18	0.923	1	3
Reported SWB difference	2.44	0.751	1	3
Social contrast	2.59	0.978	1	6
Future expectation	3.45	1.154	1	6
Male	0.480	0.492	0	1
Age (years)	37.247	17.361	15	110
Matric	0.416	0.493	0	1
Head	0.405	0.491	0	1
Unemployed	0.128	0.335	0	1
Economically inactive	0.479	0.499	0	1
Per capita Household income (Rand)	2311.6	4743.934	0	193333.3
Black African	0.805	0.395	0	1
Religious	0.899	0.300	0	1
Healthy	0.859	0.313	0	1
Neighbourhood violence	4.142	1.201	1	5
Relative income	2.633	1.001	1	6
@1 if SWB wave 5 < SWB wave 1, 2 if SWB wave 5 = SWB wave 1, 3 if SWB wave 5 > SWB wave 1				

Source: Author calculation from NIDS data

Table 2
Level of happiness in comparison to ten years ago, reported in wave 5

	All	male	female	Black African	non-black
Happier	60.18	59.8	60.45	57.99	69.27
The same	24.03	24.78	23.51	25.07	19.72
Less happy	15.79	15.42	16.04	16.94	11.01
Total	100	100	100	100	100
Source: Author calculation from NIDS data					

The majority reported being happier than ten years ago (Table 2). While the difference between male and female is not significant, there is substantial gap between the black Africans and non-blacks observed in this regard. While almost 70% of non-blacks reported being happier than ten years ago, the proportion of black Africans reporting the same was less than 60 percent.

Recall is considered as accurate when the reported change in happiness over ten years matches with the observed difference in of life satisfaction between wave 5 (2017) and wave 1 (2008). Accurate recall is observed for 42% (sum of diagonals) of individuals in Table 3. Of the accurate recall, 71% is driven by those reporting improvements in SWB over the ten year period.

We define *over reporting* (of improvement of SWB) to be when individuals report an increase in SWB (*more*) but actual change is either zero (*same*) or negative (*less*). Also, where individuals report same level of SWB over the 10 year period, but in reality it has declined. Under reporting is where individuals report decline (*less*) but actual is either same or more. Also, individuals report no change (*same*), but in reality, it has increased (*more*). In Table 3, 60% report improvement while only 44% observe it. On the contrary 15% report decline, but 42% observe it. This indicates an over-reporting in improvement and under-reporting of impairment. Overall, both contributes to an improvement bias of 43%.

Table 3
SWB Recall Bias (%): Full Sample

Observed change	Reported change			Total
	Less	Same	More	
Less	9	11	22	42
Same	3	3	8	14
More	4	10	30	44
Total	16	24	60	100
Source: Author calculation from NIDS data				

A further breakdown of recall patterns along the level of current SWB brings out interesting detail. Table 4 records the reported and actual differences in SWB for individuals with SWB below 4 on a scale 1–10. Recall is lowest among this group of individuals with 33.3% accuracy. Of the accurate recall, 77% are those reporting decline in SWB. There is evidence of under-reporting of decline, where 79% observe decline but only 32% report it. Recall is more accurate at higher levels of current SWB. On the other hand, there is over-reporting of improvement, with 34% reporting increased SWB while only 11% observe it. An improvement bias (70%) is hence evident from this among those along the left tail of the SWB distribution.

Table 4
SWB Recall Bias (%): Low SWB (0–3 on the scale 1–10)

Observed change	Reported change			Total
	Less	Same	More	
Less	25.8	25.5	27.9	79.2
Same	3.8	3.9	2.6	10.2
More	2.3	4.7	3.7	10.6
Total	31.8	34.0	34.2	100.0
Source: Author calculation from NIDS data				

Those along the middle of the SWB distribution (with life satisfaction scores 4–7) have 37% correct recall. Of the accurate recall, 73% are those reporting improvement in SWB. Once again improvement bias is noted with under-reporting of decline (12.5 vs 41.4%) and over-reporting of increase (63.4% vs 42%). Together an improvement bias is evident for those in the mid-segment of the SWB distribution. The improvement bias (53.4%) is however lower than that observed for those in the lowest segment.

Table 5
SWB Recall Bias (%): Mid-SWB (4–7 on the scale 1–10)

Observed change	Reported change			Total
	Less	Same	More	
Less	6.0	9.4	26.0	41.4
Same	1.9	4.1	10.4	16.5
More	4.5	10.6	27.0	42.1
Total	12.5	24.1	63.4	100.0
Source: Author calculation from NIDS data				

The recall performance of those at the highest end of the SWB distribution with life satisfaction score of 8 to 10 is notably higher with 67% accuracy. Of the accurate recalls, 98% come from those reporting improvement in SWB over the ten year period. Unlike the other segment of the distribution, there is no evidence of improvement bias observed in the right end of the SWB distribution. On the contrary, there is under-reporting of improvement. While 79.6% reported an increase in SWB, actual improvement was observed by 82.4%. The improvement bias hence is -2.8%. Tables 3–6 indicate improvement bias to be higher among those with lower SWB levels.

Table 6
SWB Recall Bias (%): High SWB (8–10 on the scale 1–10)

Observed change	Reported change			
	Less	Same	More	Total
Less	0.3	0.8	5.2	6.3
Same	0.9	1.2	9.3	11.4
More	5.0	12.3	65.1	82.4
Total	6.2	14.3	79.6	100.0
Source: Author calculation from NIDS data				

Figure 1 summarizes the correct recall and improvement bias observed across the three categories of SWB (low-SWB defined as between 0–3, mid-SWB as between 4–7, and high-SWB as 8 and above). Correct recall is significantly higher for the high SWB category, whereas improvement bias is highest for the low SWB category. Comparing our findings with those of Prati & Senik (2020) reveals interesting similarities as well differences. Both studies indicate the error in recall to be high at over 50%. Also, both studies find accuracy to be higher among higher SWB categories. However, the patterns of improvement bias (over-reporting of increase and under-reporting of decline) revealed through this study is different from that observed by Prati and Senik (2020). They found over-reporting to be higher for those with higher levels of SWB in their study of Britain, Germany and France. The differences in findings point to the relevance of study contexts. This questions the external validity of empirical findings developed within developed country contexts, especially for developing country contexts. South Africa, with lower average level of SWB and high SWB inequality presents different context from the European countries with high average level of wellbeing and relatively lesser inequality.

4. Multivariate Estimation Strategy

The first research question of how the past influences current SWB is tackled first using ordinary least squares regressions, as a benchmark estimation. Next, Lewbel’s heteroscedastity based internal instrument approach (Lewbel 2012, 2018) is used to address the issue of possible endogenous regressor using the STATA module *ivreg2h* (Baum and Schaffer 2012). Identification is achieved by having

regressors that are uncorrelated with the product of heteroscedastic standard errors. Given the significant correlation between *Reported_Diff* and *Actual_Diff*, each is instrumented in turn in separate Lewbel regression estimations.

Before implementing the HBIV method, it is important to conduct the requisite tests for heteroscedasticity. According to Lewbel (2012), the Breusch-Pagan (1979) test is enough to test for heteroscedasticity. Therefore, following the OLS regression, the Breusch-Pagan/Godfrey/Cook-Weisberg was conducted. Under the null hypothesis of homoscedasticity, the null hypothesis is rejected at the 1% level, therefore suggesting that heteroscedasticity is available to be exploited.

Lastly, the Hansen J test is used to test the identification restriction and tests for the validity of the instruments. The post-estimation statistics for the Hansen-J test are provided with the results. The Hansen-J test results fail to reject the null hypothesis (at the 10% significance level) that the instruments are valid.

$$y_i = \beta_0 + \beta_1 \text{Average_SWB}_i + \beta_2 \text{Actual_Diff}_i + \beta_3 \text{Social_contrast}_i + \beta_4 \text{Future_exp}_i + \beta_5 X_i + \mu_i \quad [1]$$

$$y_i = \alpha_0 + \alpha_1 \text{Average_SWB}_i + \alpha_2 \text{Reported_Diff}_i + \alpha_3 \text{Social_contrast}_i + \alpha_4 \text{Future_exp}_i + \alpha_5 X_i + \varepsilon_i$$

[2]

The dependent variable is y_i life satisfaction for individual i measured using the NIDS question “M5: Using a scale of 1 to 10 where 1 means ‘very dissatisfied’ and 10 means ‘very satisfied,’ how do you feel about your life as a whole right now?” in wave 5. The influence of the past is embedded in three variables a) , average of M5 from waves 1 to 4 to give hedonic life satisfaction for individual i b) , M6 from wave 5 to obtain the reported happiness compared to ten years ago for individual i c) actual difference in life satisfaction between the first and fifth waves calculated as the difference between life satisfaction (M5) reported in wave 5 and wave 1. Contemporary contrast is captured using the variable. Lastly, expected income rank in two-year time is used as a proxy for future expectations with the variable .

X_i is the vector of control variables incorporated based on literature on the covariates of SWB (Dolan et al. 2008; Kollamparambil 2020a; Booyesen & Botha 2011; Posel & Casale 2011; Blaauw & Pretorius 2013). These include per capita household income, employment status, education, marital status, health, age, race, gender, religiosity and neighbourhood condition. The definition of variables included in the analysis is found in Table A1.

Although the subjective well-being measure is technically ordinal, as highlighted by Ferrer-i-Carbonell and Frijters (2004), treating them as cardinal does not generally bias the results obtained. As a robustness check, the dependent variable is reclassified in 4 categories to run an ordinal logit model (Table 2 A). For this purpose, the dependent variable of life satisfaction is reclassified such that it takes the value 1 if the

reported life satisfaction ranges from 1-3, 2 if the reported life satisfaction ranges from 4-6, 3 if the reported life satisfaction ranges from 7-9 & 4 if the reported life satisfaction is 10.

In order to identify the drivers of recall (in)accuracy, we utilise a standard maximum likelihood logit model to estimate the probability of incorrect recall. The dependent variable is a binary variable for 'Incorrect recall', taking the value one ($Y = 1$) for an individual if one of the following 2 biases is observed:

1. Impairment bias: a) satisfaction in wave 5 (from M5 question in wave 5) is greater than or equal to satisfaction in wave 1 (from M5 question in wave 1), and individual reports that he/she is less happy with life than 10 years ago (from M6 question in wave 5) b) satisfaction in wave 5 is observed to be equal to satisfaction in wave 1 but is reported as being less happy with life now.
2. Improvement bias: a) Satisfaction in wave 5 (from M5 question in wave 5) is less than or equal to satisfaction in wave 1 (from M5 question in wave 1), and individual reports that he/she is happier with life than 10 years ago (from M6 question in wave 5) b) satisfaction in wave 5 is observed to be equal to satisfaction in wave 1 but is reported as being more happy with life now.

The "Incorrect recall" binary variable will equal 1 ($Y = 1$) if either of the biases are observed. The logit model takes the following form:

$$\Pr(Y_i = 1 | X_i) = \frac{1}{(1 + e^{-z_i})} \quad (3)$$

Where $\Pr(Y = 1 | X)$ is the probability of "Incorrect recall" and;

$$Z_i = \alpha_0 + \alpha_1 \text{Present_SWB}_i + \alpha_2 \text{Social_contrast}_i + \alpha_3 \text{Future_exp}_i + \alpha_4 X_i + \varepsilon_i \quad (4)$$

Although equation (3) cannot claim to be an accurately specified model given that human behaviour is intrinsically difficult to model, the contribution of it to identify the covariates of incorrect recall, while accounting for endogeneity (using Lewbel regression), is significant.

The above analysis does not differentiate between the two types of incorrect recall viz; improvement bias and impairment bias. Prati & Senik (2020), in their study of Germany, France and UK, found that happy people tend to overstate the time improvement in their life satisfaction (dynamic overestimation or improvement bias) and unhappy people tend to overstate the decline in their life satisfaction (dynamic underestimation or impairment bias). However, this study argues that this need not be a universal truth. Rather, recall bias is dependent on the SWB dynamics of a specific context as it is not just past and present, but also future expectation that influence assessment of present and past (Tatarkiewicz 1966). Therefore, the analysis of the relationship between SWB level and memory cannot be devoid of the context. Logit and Lewbel estimates are undertaken for improvement bias to get a more nuanced understanding of the recall bias.

5. Regression Results

5.1 Contrast effects

The first two research questions set out in the introduction are answered through the ordinary least squares and Lewbel heteroscedasticity based instrumental variable estimations presented in Table 7. Past average levels of subjective wellbeing (*Average SWB*) are positively and significantly correlated with current levels of SWB pointing to the hedonistic treadmill argument that individuals tend to maintain a consistent level of SWB. However, the coefficient estimates although positive and significant are not unitary, indicating that factors other than permanent personality trait also contribute to current SWB level.

The role of temporal contrast is brought out by the significance of the recall measures. The reported difference in SWB (*Reported_Diff*) is positive and significant at 99 per cent confidence level. This can be interpreted as perceived improvement from the past driving current SWB. The actual difference (*Actual_Diff*) between the present and past is also positively correlated with current levels of SWB. Comparing the OLS and Lewbel coefficients, it is clear that neglecting the feedback relationship between satisfaction level and difference from the past (Observed and Reported) leads to an underestimation of their effects. This underscores the existence of simultaneity and brings to question the past estimations in literature that do not account for endogeneity.

Further, the higher coefficient of *Actual Diff* (compared to *Reported_Diff*) lends credence to the questions raised in literature on the ability of individuals to undertake inter-temporal comparisons accurately due to objective differences in the past and present circumstances. Nevertheless, the perceived difference (even if not entirely accurate) still is an important driver of current SWB level.

The contemporary contrast variable of relative income is also positive and significant. The result reinforces the hypothesised relevance of contemporary (social) reference points in determining current SWB levels. The recall of satisfaction is not just dependent on their memory of their own life situation, but also dependent on their social comparison in the present. Also, the satisfaction due to what someone has achieved over the last 10 years may be dependent on what other people have achieved in the same time period. Brandstatter (2000) argues that social comparison can be seen as a contemporary contrast effect. Even if circumstances are not ideal, one may be relatively happy if the average experience in society is worse. As such, local and community based comparison as well as national level comparison would affect how they recall their happiness relative to now. Luttmer (2005) show that having neighbors who earn relatively higher incomes is associated with lower reported happiness. Future expectations are also seen as significant drivers of current SWB.

Along with the significance of the hedonistic, memory and contrast variables, other key variables continue to be significant. *Black African* has a significant negative coefficient in line with other studies in the South African context. *Per capita household income* has significant positive association with SWB except for the non-black households, which have higher average household incomes compared to black African households. On the other hand, neighbourhood characteristics is important across the board, with

violence having a significant and negative effect on SWB. Religion as well as self-reported health is also important for all.

Table 7
 Dependent variable: Current Subjective Wellbeing

	(OLS)	(OLS)	(Lewbel)	(Lewbel)
VARIABLES				
Average SWB	0.579***	0.0421***	0.764***	0.0386***
	(0.00885)	(0.0108)	(0.0674)	(0.0110)
Actual_Diff	2.362***		3.183***	
	(0.0225)		(0.298)	
Reported_Diff(intertemporal contrast)		0.984***		1.552***
		(0.0352)		(0.164)
Social contrast	0.187***	0.239***	0.128***	0.172***
	(0.0246)	(0.0368)	(0.0341)	(0.0420)
Future expectations	0.0609***	0.202***	0.0079***	0.195***
	(0.0206)	(0.0308)	(0.0025)	(0.0313)
Male	0.0136	-0.0145	0.0258	-0.0112
	(0.0367)	(0.0547)	(0.0400)	(0.0556)
Age	-0.00465	-9.36e-05	-0.00558	0.00104
	(0.00668)	(0.00996)	(0.00724)	(0.0101)
Age sq	7.71e-05	7.32e-05	6.83e-05	5.70e-05
	(6.68e-05)	(9.95e-05)	(7.24e-05)	(0.000101)
Education	0.0496	0.0183	0.0570	0.0112
	(0.0407)	(0.0608)	(0.0442)	(0.0617)
Household head	-0.0509	-0.116**	-0.0246	-0.109**
	(0.0361)	(0.0539)	(0.0402)	(0.0548)
Unemployed	-0.123**	0.102	-0.142**	-0.196**
	(0.0568)	(0.0850)	(0.0618)	(0.0903)
Economically inactive	-0.0680	-0.165**	-0.0177	-0.138**

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

	(OLS)	(OLS)	(Lewbel)	(Lewbel)
	(0.0432)	(0.0644)	(0.0501)	(0.0658)
Log Household income	0.0567***	0.0892**	0.0303**	0.0677**
	(0.0189)	(0.0282)	(0.0127)	(0.029)
Black African	-0.253**	-0.569***	-0.160**	-0.598***
	(0.119)	(0.178)	(0.033)	(0.181)
religious	0.242***	0.402***	0.130*	0.306***
	(0.0609)	(0.0909)	(0.0773)	(0.0963)
healthy	0.225***	0.210***	0.154**	0.0843**
	(0.0517)	(0.0774)	(0.0615)	(0.0363)
Neighbourhood violence	-0.00214	-0.0342	0.00653	-0.0377*
	(0.0149)	(0.0222)	(0.0164)	(0.0226)
Constant	1.461***	5.493***	0.862***	6.818***
	(0.234)	(0.357)	(0.333)	(0.520)
Breusch-Pagan / Cook-Weisberg test	16.59***	18.21***		
Hansen J stat			0.278	0.129
Observations	7,631	7,603	7,631	7,603
R-squared	0.631	0.183	0.567	0.155
Standard errors in parentheses				
*** p < 0.01, ** p < 0.05, * p < 0.1				

5.2 Recall Accuracy

Section 3 has revealed only 42% recall accuracy within our sample. In this section, we explore the variables that are closely associated with recall inaccuracy. The results of binary logit regression indicate that higher levels of current SWB is negatively associated with incorrect recall (Table 8). The upward bias brought about through the simultaneity in relationship between level of satisfaction and recall accuracy is evident from the reduced magnitude of the coefficient in the Lewbel estimation. Nevertheless, the sign of the coefficient is retained, albeit at a lower confidence level. These findings are aligned with psychology literature (Lieberman et al. 2009) that predicts happier individuals to have more ability to recall accurately. However, our results emphasize the need to consider endogeneity bias in the estimation of the relationship between recall accuracy and current satisfaction.

A non-linear effect of current SWB is observed in models 3 and 4, with the effect of current SWB being negative and stronger at higher levels of SWB (Table 8). The black African population as well as the head of the household are observed to have significantly lower probability of inaccurate recall. Future expectations are seen to have significant negative association with incorrect recall. However, social contrast is observed to contribute positively to incorrect recall. This can be explained better by looking deeper into the nature of bias (Table 9).

Table 8
 Incorrect Recall, Dependent variable Y = 1 for Incorrect recall, 0 for correct recall

	(Logit Marginal effects)	(Lewbel)	(Logit Marginal effects)	(Lewbel)
VARIABLES	(1)	(2)	(3)	(4)
w5_a_wbsat	-0.0559***	-0.0276*		
	(0.00216)	(0.0157)		
w5_swb = 1			0.0395	-0.122
			(0.0254)	(0.0973)
w5_swb = 2			0.0283	0.0430
			(0.0220)	(0.0660)
w5_swb = 3			0.0519***	0.0255
			(0.0196)	(0.0658)
w5_swb = 4			0.00343	-0.0647
			(0.0184)	(0.0965)
w5_swb = 6			-0.0964***	-0.181*
			(0.0180)	(0.107)
w5_swb = 7			-0.196***	-0.323***
			(0.0184)	(0.100)
w5_swb = 8			-0.299***	-0.426***
			(0.0202)	(0.0792)
w5_swb = 9			-0.338***	-0.490***
			(0.0297)	(0.0800)
w5_swb = 10			-0.416***	-0.490***
			(0.0209)	(0.0688)
Social contrast	0.0228***	0.0127**	0.0151**	0.0158**
	(0.00726)	(0.00118)	(0.00725)	(0.00740)
Future expectations	-0.0182***	-0.0249***	-0.0160***	-0.0141**
	(0.00610)	(0.00716)	(0.00607)	(0.00640)

Source: Author estimated from NIDS data, Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

	(Logit Marginal effects)	(Lewbel)	(Logit Marginal effects)	(Lewbel)
male	-0.00420	-0.00322	-0.00128	-0.00127
	(0.0107)	(0.0108)	(0.0106)	(0.0107)
age	-0.00386**	-0.00366*	-0.00315	-0.00310
	(0.00196)	(0.00198)	(0.00193)	(0.00195)
agesq	3.86e-05**	3.42e-05*	2.99e-05	3.02e-05
	(1.96e-05)	(1.99e-05)	(1.93e-05)	(1.95e-05)
highmatric	-0.00356	-0.00512	-0.00207	0.000394
	(0.0120)	(0.0121)	(0.0119)	(0.0120)
head	-0.0257**	-0.0216**	-0.0250**	-0.0264**
	(0.0106)	(0.0109)	(0.0105)	(0.0106)
Unemployed	-0.0142	-0.0115	-0.0134	-0.0122
	(0.0166)	(0.0168)	(0.0164)	(0.0166)
Economically inactive	-0.0128	-0.00670	-0.00451	-0.00384
	(0.0127)	(0.0133)	(0.0126)	(0.0128)
Log Household income	4.91e-07	2.23e-07	5.62e-07	6.69e-07
	(5.45e-07)	(5.69e-07)	(5.40e-07)	(5.52e-07)
Black African	-0.0920**	-0.0749**	-0.0995***	-0.107***
	(0.0358)	(0.0373)	(0.0355)	(0.0362)
Religious	0.00569	-0.0107	-2.67e-05	0.00116
	(0.0176)	(0.0199)	(0.0175)	(0.0178)
Healthy	0.000482	-0.0114	-0.00393	0.000623
	(0.0154)	(0.0168)	(0.0152)	(0.0155)
Neighbourhood violence	-0.00313	-0.00215	-0.00264	-0.00259
	(0.00436)	(0.00443)	(0.00433)	(0.00443)
Constant	1.050***	0.949***	0.859***	0.920***

Source: Author estimated from NIDS data, Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

	(Logit Marginal effects)	(Lewbel)	(Logit Marginal effects)	(Lewbel)
	(0.0681)	(0.0883)	(0.0680)	(0.0883)
Breusch-Pagan / Cook-Weisberg test(post OLS)	17.67***		23.63***	
Hansen J stat		11.05		12.29
Observations	9,179	9,179	9,198	9,198
R-squared	0.075	0.058	0.091	0.083
Source: Author estimated from NIDS data, Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1				

Instrumented: w5_a_wbsat (2), w5swb1 w5swb2 w5swb3 w5swb4 w5swb6 w5swb7 w5swb8 w5swb9 w5swb10(4)

Included instruments: male age agesq highmatric head unemployed eco_inactive w5tinc black African religious healthy neighbourhood violence relincome5 w5fwbstp2yr

Further to the binary logit for incorrect recall regression we next undertake estimation to uncover the nature of bias within incorrect recall. The inaccuracy can emanate from either reported change in SWB being higher than it actually is observed (improvement bias), or from reported change in SWB being lower than actually observed (impairment bias). Table 9 presents the results of the logit and Lewbel estimation of improvement bias. A negative relationship is found between the level of SWB and improvement bias. The relationship is however not linear. At lower levels of SWB increase in SWB increased improvement bias. On the contrary, a negative relationship is found with improvement bias at higher levels of SWB. The signs of the coefficients are positive and significant at the lowest levels of SWB, and negative and significant at the highest levels of SWB.

The positive sign of coefficients associated with SWB1 and SWB2 means that, everything else being equal, respondents with low levels of SWB are more likely to over-estimate improvement and more likely to over-report improved SWB than someone with SWB = 5. The coefficients are negative and significant for SWB > = 7, indicating that respondents with high SWB are less likely to over-report SWB. These results are different to the findings of Pratik and Senik (2020) who found happy people tend to overstate the improvement in their life satisfaction and less happy people to under report improvement in their life satisfaction.

The findings of this study need to be understood in the South African context of low average SWB and high SWB inequality. Nevertheless, what is remarkable is that SWB inequality has been falling in recent times despite increasing income inequality (Kollamparambil 2020a). Kollamparambil and Mathentamo (2020) attributes reducing SWB inequality to the non-income factors that drive SWB like increased access to public amenities among the previously deprived population and the political empowerment of the

majority (with low SWB levels due to decades of apartheid discrimination) brought about by the end of apartheid and shift to majority government. While these factors have contributed to an increase in SWB among the less happy, the improvement bias is driven by the enhanced optimism and hope for future even though the material and economic challenges for the vast majority remain resulting in low current SWB level. On the other hand, the privileged minority which has high level of SWB attributed to higher economic status, find themselves politically side-lined under the democratic black African majority government. The perceived fall in SWB can be attributed to increasing anxiety and pessimism (Hook 2020), despite the continued economic privilege that retains the high average current SWB (Kollampambil (2020b)). The mirage effect therefore is seen to operate differently at different ends of the SWB spectrum, fed by the stark economic and SWB inequality which is increasingly divorced from political empowerment and hope for future.

Table 9
Improvement bias, Dependent variable Y = 1 for Improvement bias, 0 otherwise

	(1)	(2)	(3)	(4)
VARIABLES	(logit)	(lewbel)	(logit)	(lewbel)
w5_a_wbsat	-0.0557***	-0.0385*		
	(0.00309)	(0.0210)		
w5_swb = 1			0.101***	0.130**
			(0.0310)	(0.0541)
w5_swb = 2			0.122***	0.137***
			(0.0257)	(0.0509)
w5_swb = 3			0.0516**	0.0639
			(0.0227)	(0.0467)
w5_swb = 4			0.0216	-0.0613
			(0.0217)	(0.0804)
w5_swb = 6			-0.0644***	-0.0345
			(0.0222)	(0.0958)
w5_swb = 7			-0.137***	-0.188**
			(0.0242)	(0.0906)
w5_swb = 8			-0.295***	-0.266***
			(0.0294)	(0.0801)
w5_swb = 9			-0.329***	-0.324***
			(0.0477)	(0.109)
w5_swb = 10			-0.358***	-0.417***
			(0.0355)	(0.0691)
Social contrast	0.0693***	0.0638***	0.0675***	0.0705***
	(0.00950)	(0.0116)	(0.00956)	(0.00975)
Future expectations	0.0254***	0.0220**	0.0249***	0.0253***
	(0.00789)	(0.00892)	(0.00791)	(0.00815)

Source: Author estimated from NIDS data, Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

	(1)	(2)	(3)	(4)
Male	-0.00128	-0.00111	-0.000908	-0.00141
	(0.0137)	(0.0137)	(0.0137)	(0.0137)
Age	-0.00675***	-0.00649***	-0.00677***	-0.00657***
	(0.00249)	(0.00251)	(0.00248)	(0.00250)
Age squared	7.01e-05***	6.64e-05***	6.88e-05***	6.64e-05***
	(2.49e-05)	(2.53e-05)	(2.48e-05)	(2.50e-05)
Education	0.0592***	0.0575***	0.0596***	0.0586***
	(0.0153)	(0.0154)	(0.0153)	(0.0154)
Household head	0.000838	0.00304	0.000585	0.00162
	(0.0135)	(0.0138)	(0.0135)	(0.0137)
Unemployed	-0.130***	-0.132***	-0.130***	-0.129***
	(0.0212)	(0.0214)	(0.0212)	(0.0213)
Economically inactive	-0.0450***	-0.0410**	-0.0394**	-0.0391**
	(0.0160)	(0.0168)	(0.0160)	(0.0163)
Log per capita Household income	1.15e-06*	1.04e-06	1.16e-06*	1.07e-06*
	(6.20e-07)	(6.36e-07)	(6.19e-07)	(6.37e-07)
Black African	-0.139***	-0.122**	-0.140***	-0.148***
	(0.0450)	(0.0498)	(0.0449)	(0.0454)
Religious	0.0744***	0.0666***	0.0705***	0.0761***
	(0.0220)	(0.0240)	(0.0220)	(0.0222)
Healthy	0.0907***	0.0890***	0.0915***	0.0913***
	(0.0194)	(0.0195)	(0.0193)	(0.0195)
Neighbourhood violence	0.0193***	0.0199***	0.0196***	0.0203***
	(0.00566)	(0.00571)	(0.00565)	(0.00575)
Constant	0.660***	0.589***	0.432***	0.429***
	(0.0865)	(0.123)	(0.0865)	(0.0958)

Source: Author estimated from NIDS data, Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

	(1)	(2)	(3)	(4)
Breusch-Pagan / Cook-Weisberg test	61.87***	21.22***		
Hansen J stat		0.23	18.79	5.34
Observations	5,047	5,047	5,057	5,057
R-squared	0.123	0.118	0.130	0.123
Source: Author estimated from NIDS data, Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1				

Instrumented: w5_a_wbsat (Model 2), w5swb1 w5swb2 w5swb3 w5swb4 w5swb6 w5swb7 w5swb8 w5swb9 w5swb10 (Model. 4)

Included instruments: male age agesq highmatric head unemployed eco_inactive w5tinc black African religious healthy neighbourhood violence relincome5 w5fwbstp2yr

5.3 Study Limitations

While the results clearly point to hedonic adaptation and the relevance of memory through contrast effects, our analysis is not without limitations. The cardinal validity of subjective well-being reports has been called into question given that the individual-specific nature of formulating one's level of SWB would make measuring and interpreting subjective well-being difficult between people and over time. The current study is based on the strength of Kaiser (2020) results that indicates that although, in principle, the violation of the assumption of *common scale use* could lead to sign reversals of coefficient estimates, in practice, it is unlikely and results in downward bias in the coefficient estimates.

While the primary objective is to find whether people accurately recall SWB or not, it may be of additional value to distinguish between complete recall and other 'levels' of recall. For example, reporting higher SWB as a response to level of happiness compared to ten years ago, is documented as correct recall as long as wave 5 SWB level is higher than wave 1 SWB level. Technically, the difference however could take any value between 9 to 1 but is not differentiated in the analysis. This is an area that presents itself for future research.

6. Conclusion

This study is an attempt to analyse the interrelationships between current, past and expected future SWB through the intermediating role of memory. The contribution of this study is in exploring the role of contrast (inter-temporal and social) in determining; a) the current levels of SWB and, b) the drivers of recall bias; within a causal framework in the context of a country with low average SWB and high SWB inequality. While psychology literature has made attempts in understanding the intermediating role of memory through which past influences the present level of SWB, these studies for the most part ignore

the simultaneity in the relationship between recall of past SWB and current SWB level. Methodologically, the study contributes to literature by using the Lewbel heteroscedasticity based instrumental variable estimation to account for possible bias arising out of endogeneity.

The key objective of understanding the association between past and present SWB is achieved by exploring hedonic adaptation, memory and contrast variables in the analysis. The contrast variables included, apart from the conventional contemporary social contrast, intertemporal contrast (past as well as future expectations). Both the ordinary least squares as well the Lewbel regression are consistent in their findings that; a) past levels of SWB are positively and significantly correlated with current levels of SWB, offering support to the hedonic adaptation argument that individuals tend to maintain a consistent level of SWB; b) a perceived improvement in current happiness from the past, is associated with higher levels of current SWB, highlighting the intermediating role of memory; c) the contemporary (social) contrast variable of relative income is positive predictor of current SWB in line with Brandstatter (2000) and Luttmer (2005); d) lastly, the study also finds future expectations to be a significant driver of current SWB. These findings lend support to Tatarkiewics (1966) that current levels of SWB reflect past levels, as well as future expectations.

These initial findings underline the importance of memory and raises the question of recall accuracy. It is therefore noteworthy that only 42% record accurate comparison between present and past SWB. Along the lines of Prati and Senik (2020), this study records an overall improvement bias and identifies incorrect recall to be negatively associated with current level of life satisfaction. The latter finding is also in keeping with psychology literature (Lieberman et al 2009) that predicts happier individuals to have more ability to recall accurately.

The above similarities with Prati and Senik (2020) aside, there are key differences to note as well. This study found a negative relationship between the current level of SWB and improvement bias. The relationship is however not linear. Current SWB is observed to have a positive association with improvement bias only at lower levels of SWB. On the contrary, current SWB has a negative association with improvement bias at higher levels of subjective wellbeing. These findings differ from Prati and Senik (2020) who found improvement bias to be prominent among happy individuals. The different outcome observed in the South African context is explained by the crossover effects between present SWB and future expectations. Within the context of declining SWB inequality and improved future expectations of previously disadvantaged (less happy) individuals under the democratic government, it is not surprising that improvement bias is higher among those on the left end of the SWB distribution. Similar conclusions were arrived at by Moller (1996) in a study of college students in South Africa, where the black African students with lower mean levels of SWB had higher future expectations compared to others. The difference in the finding from Prati & Senik (2020) underscores the relevance of dynamics within the lived realities of individuals in driving recall bias.

Overall, this study finds that while past and future shape the present, memory recall and bias are also shaped by the present and future expectations. The results, reinforce the hypothesized simultaneous

relationships between current SWB, inter-temporal contrast, and recall behaviour.

Declarations

Compliance of ethical standard statement:

Disclosure of potential conflicts of interest: The author declares that there are no conflicts of interest or competing interests.

Research involving Human Participants and/or Animals: NA, no primary data was collected for this study

Informed consent:

NA, no primary data was collected for this study

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Figures

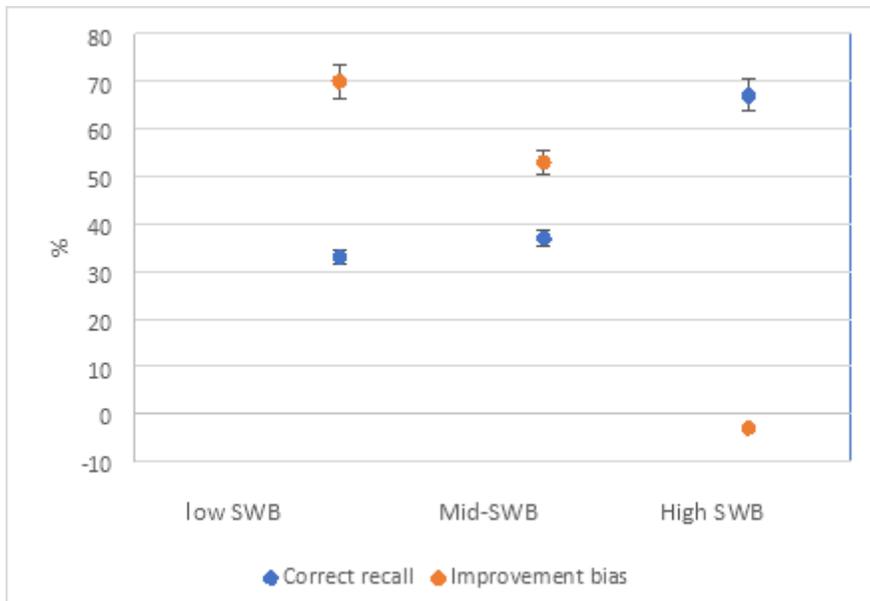


Figure 1

Recall Patterns across SWB levels

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