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**Conference Paper**

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Beiträge zur Jahrestagung des Vereins für Socialpolitik 2014: Evidenzbasierte Wirtschaftspolitik  
- Session: Welfare Economics, No. F07-V1

**Provided in Cooperation with:**

Verein für Socialpolitik / German Economic Association

*Suggested Citation:* Maschke, Philip; Döpke, Jörg (2014) : Are there Business Cycles beyond GDP? Alternative Measures to GDP at Business Cycle Frequencies, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2014: Evidenzbasierte Wirtschaftspolitik - Session: Welfare Economics, No. F07-V1, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Kiel und Hamburg

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# Are there Business Cycles “beyond GDP”? Alternative Measures to GDP at Business Cycle Frequencies

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This version: February 2014

## Abstract

We discuss properties of alternatives or complements to GDP as a measure of welfare at business cycle frequencies. We argue that these figures are not useful to measure the welfare costs of business cycles. First, data is not available at an appropriate quality and frequency. Second, since the suggested time series sometimes correlate negatively with each other composite indices will lead by construction to very low welfare costs of business cycles. Third, cross-section and quasi-panel evidence based on different samples of countries reveals no impact of the stance of the business cycle on some suggested welfare measures.

JEL-Classification: D06, E01, E32, I31

Keywords: Welfare Measurement, Social Indicators, Beyond GDP,  
Business Cycles

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Acknowledgments: The authors would like to thank participants of the 8th Workshop “Makroökonomik und Konjunktur”, ifo Dresden November 2013, in particular Sebastian Watzka, for helpful comments on a previous draft of this paper.

We thank Declan McEvilly and Joshua Veasey for intensive proof reading and helpful comments.

# 1 Introduction

In the aftermath of the financial crisis beginning in 2007 alternative measures of human well-being have (again) entered the focus of the economic policy debate. While the topic had been part of the scientific discussion for a very long time (see Simonis (2011) for an overview), the so-called “Stiglitz-Report” (Stiglitz et al. (2009)) – initiated by the then French president Sarkozy – has drawn interest of public opinion towards this issue recently. Apparently, a wider audience has the impression that economists view (real, per capita) Gross Domestic Product (GDP) (or its close relatives like GNP) as an almost perfect measure of economic welfare.

In contrast to this view, basically every undergraduate textbook makes clear from the very beginning that real GDP is, at best, a very imperfect measure of welfare (see Henderson (2010) or Kuznets (1934)). Furthermore, it is somewhat puzzling for economists that the recent debate is related to a cyclical phenomenon, like the down-swing after the financial market crisis, since most of them would tend to see the alternatives to GDP not primarily constructed to measure business cycles (see, however, the early contribution of Simonis (1979)). Hence, most economists would see the main challenges to the profession raised by the so-called “Great Recession” in fields of, say, macroeconomics, financial markets regulation or forecasting rather than in improving the measurement of economic welfare.

Nevertheless, a certain aspect of cyclical behavior of at least one suspected alternative to GDP has been the subject of intensive interest in recent scientific literature. Deaton (2012) analyzes the impact of the “Great Recession” on self-reported well-being (SWB) in the US and concludes: “Even large macroeconomic shocks to income and unemployment can be expected to produce only small and hard to detect effects on SWB measures.” (Deaton (2012): abstract). In a similar vein, Mertens and Beblo (2011) discuss the development of subjective well-being in Germany and the UK during and after the crisis.<sup>1</sup>

Walsh (2011), who analyzes the impact of macroeconomic variables on SWB, mental health (suicide and alcoholic disorders) and on birth rate data for the Irish economy finds that the current recession has no impact on life satisfaction using either the unemployment or inflation rate as explanatory variables. These results are also true for the other indicators with only the suicide rate of younger males experiencing a significant positive link with the unemployment rate. While Deaton (2012) and Mertens and Beblo (2011)

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<sup>1</sup>The authors find, surprisingly as they themselves argue, that the impact of the crisis on well-being differs between West- and East-Germany. With the reaction of East Germans tending to be similar to the pattern observed in the UK.

tend to view changes in happiness as less pronounced than downswings of real GDP, Wolfers (2003) by contrast, uses happiness data to assess the welfare losses caused by business cycles. He finds a relatively strong cycle in happiness. Furthermore, he finds subjective well-being to be pro-cyclical with regard to real GDP as the reference cycle and concludes, that the data is suitable to estimate welfare costs of business cycles. In fact, the impact of macroeconomic conditions on happiness data is a broad and lively strand of the literature (see Di Tella and MacCulloch (2006) for an overview).

Yet another development points to the cyclical pattern in time series related to possible negative external effects of production using mortality and health data. In their analysis Stuckler and Basu (2013) argue that “austerity kills”. Their work disagrees with Stevens et al. (2011) who analyze health related time series, in particular mortality, and show a pro-cyclical pattern. Thus, according to their results a business cycle slump will generally be related with fewer deaths. Sharing the point, Egan et al. (2013) also argue that mortality is pro-cyclical. Including the health situation of the population into a business cycle measure would show “recessions are not as bad because of reduced mortality” (see Egan et al. (2013), abstract).

In this paper, we analyze cyclical properties of series that should – at least according to some authors (see Costanza et al. (2009) for an overview) – replace or complement GDP. We do so in two different ways. First, we look at the time series dimension regarding various quality of life indicator series for Germany. To this end, we analyze both variables that are suggested to be part of indicator sets to complement GDP as well as composite indices, which principally can replace GDP as the main measure of business cycles. For the first analysis we use 12 quality of life indicators taken as representatives of the following welfare dimensions: subjective well-being, environment, security, health, sustainability and equality. The latter includes these indices: Progress Index (PI), Happy Planet Index (HPI), Index of Economic Well-Being (IEWB), Social Progress Index (SPI), Sustainable Governance Indicators (SGI) and Human Development Index (HDI). Second, due to the lack of data in the time series dimension, we also exploit the cross-section dimension of the data that are available, at least for a group of countries.

Our main results indicate that alternatives to GDP are not yet useful to measure business cycles. First of all, data is not available at appropriate quality and frequency. Second, some of the suggested time series correlate negatively with each other at business cycle frequencies. This implies very low welfare costs of business cycles (if any at) all when using composite indices. Third, cross-section evidence based on a sample of countries also suggests almost no impact of the stance of the business cycle on some proposed welfare measures.

The remainder of the paper is organised as follows: Section 2 briefly reviews the “beyond GDP” literature and the methodology of alternative measures and gives an overview on the quality of life indicators as well as alternative measures to GDP used in the analysis. Section 3 refers to the discussion of stylized facts of the business cycle and examines whether such facts can be established with regard to the alternative measures. Section 4 uses information available for cross-sections of countries to explore the link between cyclical situations in a country and its welfare as approximated by alternative measures. The last section concludes.

## 2 Alternative Measures to GDP

In recent years a growing number of alternative progress measures have evolved globally (Wesselink et al. (2007), Bleys (2012) for an overview). Bandura (2008) found 178 composite indices worldwide that assess country performance on local, regional or national levels. The indices are issued by a variety of private and public institutions and organizations.

The focus of alternative measures is to gauge the well-being of nations by taking aspects into account that are not covered, directly nor indirectly by GDP or other economic indicators. Their aim is to show a different picture to what is thought to be the “mainstream” economic view on well-being. Alternative progress measures go “beyond GDP” in the sense that they include a number of welfare dimensions like social affairs (i.a. health, education), the environmental or ecological situation, governance, sustainability aspects or SWB of a nation.

Main drivers of the increasing supply and popularity of alternative measures has been the debate in politics and academia triggered by the so called “Stiglitz-report” (Stiglitz et al. (2009)). It proposed reforms on GDP accounting and suggested to give more credit to indicators that measure quality of life and sustainable development. As a follow up organizations started campaigns like the OECD “Better Life Index” (OECD (2011)) or the “Beyond GDP” initiative of the EU European Commission (2013b).

### 2.1 Classification

A certain number of classification schemes for alternative measures already exist with varying classification approaches (Bleys (2012)). One of them also used by Kassenboehmer and Schmidt (2011) classifies alternative indicators concerning their relation to GDP with (i) those that alter GDP (i.e. Measure of Economic Welfare (MEW)), (ii) those that complement GDP with

additional indicators (i.e. Sustainable Development Indicators (SDI)) and (iii) those that entirely scale off from GDP (i.e. Ecological Footprint (EF)) (Goossens and Mäkipää (2007)).

We use a form of classification which is also used by van Suntum and Lerbs (2011). This approach sorts progress measures according to their form of aggregation. There are two main groups of indicators. The first group is comprised of aggregated single number indicators (like GDP); the second group is comprised of indicator sets - a bundle of non-aggregated indicators (Wesselink et al. (2007)). Indicators of the first group can be further divided into two sub-groups. First, adjusted economic indicators (“Green GDPs”) are calculated in the way that welfare enhancing goods are added to and welfare decreasing “goods” are subtracted from economic indicators such as Net National Income (NNI). Second, composite indicators are comprised of a selection of indicators which are aggregated to certain welfare dimensions. Three variations of composite indicators have evolved that use different kinds of data, those which: (i) exclusively use “objective” data like statistical figures i.e. life expectancy rates, (ii) exclusively use “subjective” data like self-reported well-being questionnaires and (iii) use a combination of both data types (Wesselink et al. (2007)). For our analysis we only make use of composite indicators. Thus in the following only those will be looked at in more detail.

## 2.2 Construction of Composite Indicators

Composite indicators are based on a set of sub-indicators which are aggregated to a single number indicator. The sub-indicators are often characterized by neither having a common unit of measurement nor an obvious weighting scheme (Saisana and Tarantola (2002)). Subjective judgment is involved at various stages of the construction process i.e. at the indicator selection process or choice of the aggregation model (Nardo et al. (2005)). In the following we will focus on parts of the construction process by looking at the multivariate analysis, normalization, weighting of the underlying variables and aggregation procedures of the composite indicators that were used in the analysis.

*Multivariate analysis* is a tool to analyze the underlying data which is to be used in the composite indicator. The analytical methods applied here are: factor analysis, Cronbach Coefficient Alpha (Cronbach (1951)) or Cluster Analysis. The purpose if these methods are to measure the degree of correlation among indicators which shows data set suitability (JRC (2008)). Although there is a debate on whether correlation of variables in composite indicators is desirable (see Chowdhury (1991), McGillivray (1991) for discus-

sion on the HDI).

*Normalization* is required prior to data aggregation because in composite indicators data of different sub-indicators often have different measurement units. A range of normalization techniques exist and they have to take into account the data properties as well as the objectives of the composite indicator (JRC (2008)).

*Weighting* is applied not only in the final aggregation process but also before that when the dimensions of the indicator are aggregated. A number of weighting methods are used, with some using statistical models i.e. factor analysis; others use expert ratings and some composite indicators are based on a mixture of both techniques. Usually equal weighting is applied on composite indicators which can become a problem with variables that have a high degree of correlation, as then a sort of double counting can occur (simple addition of both weights) (JRC (2008)). No matter what kind of weighting method is applied weights are always value judgments.

*Aggregation* of the overall measure is the last step in the construction process. The methods applied involve linear methods, geometric methods or multi-criteria methods. The first mentioned is useful when all individual indicators have the same measurement unit. Geometric aggregations are better suited for non-compensability between individual indicators. In both methods weights express trade-offs between indicators. A deficit in one dimension can be offset by a surplus in another. The multi-criteria approach assures non-compensability by finding a compromise between two or more legitimate goals (JRC (2008)).

## 2.3 Composite Indices applied in the Analysis

For the cross section analysis we have chosen composite indices which have been published in recent years on a national level. The analysis covers 6 composite indicators with three of them (PI, IEWB, HDI) available as time series (see Table 1 for an overview). Authors of the indices are NGOs (HPI, SPI), academia (IEWB), research institutes (PI, SHI) and an intergovernmental organization (HDI).

Certain obstacles have been discovered when working with the measures. First, the year of origin of underlying data for composite indicators differs heavily within the indices i.e. the IEWB uses data between 1990 and 2011. The reason for that is data availability for a number of indicators is not satisfactory and data take up by statistical offices in many cases only happens in long intervals. Second, coming together with the first constrained, data underlying a sub-indicator can also come from a certain time span and differ between countries, i.e. SWB data for each country of the HPI has been

Table 1: Composite Indices

Index	Reference	Coun-tries	Time-series	Indica-tors	Data
Progress Index	Zentrum für gesell. Fortschritt (2011)	22 (OECD)	Yes (1970-2009)	4	2000-2010
Happy Planet Index	Abdallah et al. (2012)	151	No	3	2008-2011
Index of Economic Well-Being	Osberg and Sharpe (2011)	14 (OECD)	Yes (1980-2009)	14	1990-2001
Social Progress Index	Porter et al. (2013)	50	No	52	Not available
Sustainable Governance Indicators	Bertelsmann Stiftung (2011)	31 (OECD)	No	147	2003-2010
Human Development Index	UNDP (2013)	181	Yes (1980-2010)	4	2009-2010

Source: Table by authors.

taken up in the time period 2006-2011. The problem of data quality is seen by the two authors of the IEWB who mention that “the existing literature is of variable quality – and often differs across countries” (Osberg and Sharpe (2002)). Third, a number of composite indices (HPI, SPI, PI) take the EF as an indicator for sustainability which is already aggregated artificially. The underlying data was available for all indices except the SPI. Methodologies for all composite indicators are provided but quality and details differ widely.

In Table 2 parts of the construction process of the six composite indices used in the analysis are shown. Overall the methodology reports try to give a transparent picture of the construction processes of each measure. However as there is not standardized reporting scheme information given differs widely. This is the case for the selection processes of the sub-indicators which is only given in detail by a number of composite indicators. Rather diverse methods are used for the normalization processes. Some alternative measures applied the distance to a reference country or the distance to a reference year method (HPI, IEWB, SGI). The HDI applies the Min-Max normalization and PI and SPI apply factor analysis.

Equal weights are the dominant choice of the composite indicators of our analysis (IEWB, SPI, SGI, HDI). Besides that the PI uses co-integration test results for weighting and fixes the weight of the EF used for the sustainability dimension. The SGI uses a combination of quantitative methods and



Table 2: Construction Methods of Composite Indices

Index	Multivariate Analysis	Normali- zation	Weighting <sup>1</sup>	Aggregation
Progress Index	Unit Root tests	none	Cointegration test, EF: fixed weight of 0.2	multi-criteria method
Happy Planet Index	Method not specified	Distance to reference indicator	various	multi-criteria method
Index of Economic Well-Being	Method not mentioned	Difference to basic year	equal ( $w = \frac{1}{4}$ )	linear method
Social Progress Index	Factor Analysis Cronbach's Alpha	Standard deviation <sup>2</sup>	equal ( $w = \frac{1}{3}$ )	linear method
Sustainable Governance Indicators	Method not mentioned	Expert rating & Distance to reference state <sup>3</sup>	experts/equal	linear method
Human Development Index	No method mentioned	Min-Max method	equal ( $w = \frac{1}{3}$ )	geometric method

Notes: *weights* =  $w$ ;

<sup>1</sup> Weighting of overall composite indicator

<sup>2</sup> Results used for weighting of indicators within dimensions.

<sup>3</sup> Expert ratings based on unified scale. For quantitative data relative distance from best performing state using a unified scale (worst=1, best=10).

Source: Table by authors according to Böhringer and Jochem (2007).

expert rating while the HPI applies different kinds of weights to its indicators with no further explanation of the reasons behind it. The application of the aggregation methods is also rather diverse with linear methods fairly dominant. The IEWB, SPI and SGI apply a linear mean; the HDI after a revision process in 2010 (UNDP (2010)) now uses the geometric mean. The PI is aggregated with the weights found using econometric methods this is also the case for the HPI.

Table 3 shows which well-being dimensions are covered by the alternative measures: Economy, social affairs, environment, governance and SWB are covered by the composite indicators of our analysis. None of the indicators cover all five dimensions and only the SGI covers four dimensions. At least three dimensions are covered by four indicators. Social affairs are covered by five out of six measures followed by the economy and environment. Surprisingly only one measure covers SWB while governance is only covered by two

Table 3: Alternative Measures and Welfare Dimensions

Index	Eco- nomy	Social Affairs	Environ- ment	Govern- ance	SWB
Progress Index	X	X	X		
Happy Planet Index		X	X		X
Index of Economic Well-Being	X				
Social Progress Index		X	X	X	
Sustainable Governance Indicators	X	X	X	X	
Human Development Index	X	X			

Source: Table by authors.

indicators.

When we evaluate the six alternative progress measures we find that certain obstacles exist. First, data availability and timeliness for the indicators in some cases is not sufficient. Second, although the concept of well-being is rather fluid the observed indices are far from reflect the whole concept which in this case means all well-being dimensions (see Table 3). Third, the selection process of the indicators is often driven by data availability rather than if the indicator describes the phenomenon accurately. Fourth, as the construction and calculation processes are made transparent the methodologies still lack sufficient information on parts of the processes. Against the background that composite indicators of progress are not only meant to inform policymakers with country rankings on national developments, but also to actively be used as support for policy guidance and decisions (Bandura (2005)) . Poorly constructed measures can send misleading policy messages or can lead to the misinterpretation of composite indicators. (Nardo et al. (2005)). Our findings put a question mark on the reliability of these measures. Our critique on the methodological basis is also shared by the German Council of Economic Experts’ study on quality of life measures where they completely refuse the use of composite indices because of value judgment problems (SVR/CAE (2010)). The view is also shared by Böhringer and Jochem (2007) who looked at sustainable development indicators and came to the conclusion that although being transparent and concise these measures lack “fundamental scientific requirements”.

## 2.4 Quality of Life Indicators applied in the Analysis

For our analysis of the cyclical behavior and the cross section analysis we use 12 quality of life indicators available for Germany (Table 4). These indicators are often taken as benchmarks for specific welfare dimensions. Some of them have been proposed by the SVR/CAE (2010) study on a quality of life indicator set. Data was available mostly for the time period 1971-2011 however there are two negative spikes which are only available from 1991 onwards. This is the case for the bird index used to measure biodiversity as well as for a statistic on research and development in Germany. Data availability for quality of life indicators is a problem and makes analysis of longer time series nearly impossible.

## 3 Analyzing the Cyclical Behavior of Selected Alternatives and Complements to GDP

### 3.1 Reference Series and Cycles

The notion “stylized facts” has been introduced into business cycle research in a seminal paper by Lucas (1977). Since then, a lot of papers have investigated properties of time series used to measure the cyclical situation of a country. In this section we ask, whether the broad picture of cyclical fluctuation would change, if we switch to social indicators as the headline measure of the economic situation of a country. As a first step we aim at establishing some stylized business cycle facts of the time series that should replace or complement GDP. We do so by measuring the business cycle component of the series at hand by either applying the change over the previous years or by the cyclical component of a Hodrick and Prescott (1997)-filter.

We use a smoothing parameter of 6.25, thus following Ravn and Uhlig (2002), that is, we assume fluctuations shorter than 2 and longer than 8 years not belonging to the business cycle frequency (Baxter and King (1999)). Figure 1 compares this series with a standard measure of the business cycle, the Output gap provided by the European Commission (2013a). It becomes apparent, that both measures show no qualitatively different picture of the business cycle. The recession phases also plotted in Figure 1 are the phases provided by the Economic Cycle Research Institute (2013). We therefore refer to the “classical” business cycle dating concept that traces back to the NBER dating concept.

Table 4: Quality of Life Indicators

Indicator	Welfare dimension	Time Period	Reference	Unit
Real GDP per capita	(Reference series)	1971-2012	European Commission (2013a) Rübenach (2007)	\$ in 2005 prices
Number of suicides	Subjective well-being	1980-2011	Statistisches Bundesamt (various issues)	Persons
Self-reported happiness	Subjective well-being	1975-2011	European Commission (2013c) and own calculation after Wolfers (2003)	Index, 1 (very unhappy) to 4 (very happy)
CO <sub>2</sub> emissions	Negative externalities/Environment	1971-2011	IEA (2010)	Million tons
Persons in prison	Negative externalities/Security	1971-2011	Statistisches Bundesamt (2013b)	Persons
Persons killed or injured in traffic	Negative externalities / health	1971-2011	Statistisches Bundesamt (2013c)	Persons
Life expectancy	Health	1971-2011	OECD (2014)	Years
Infant mortality	Health	1971-2011	World Bank (2013)	Infant mortality per 1000 live births
“Years Lost”	Health	1971-2011	OECD (2014)	Years
Overall mortality rate	Health	1971-2011	Statistisches Bundesamt (2013a)	Deaths per 1000 inhabitants
Bird Index	Biodiversity	1991-2008	Eurostat (2013)	Index (2000=100)
Research and Development	Sustainability	1991-2011	Bundesministerium für Bildung und Forschung (2013)	Euro
Adjusted wage share	Equality	1971-2011	European Commission (2013a)	% of GDP

Notes: Data for real GDP capita and adjusted wage share have been adjusted for German unification by splicing in West German data before unification.

Source Own calculations.

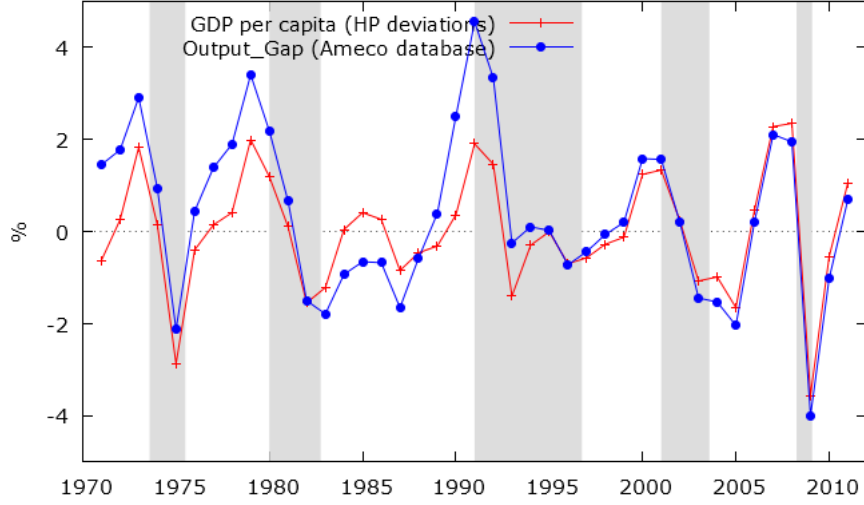


Figure 1: Output Gap and Recession Phases in Germany

Source: *European Commission (2013a)* for Output gap and GDP per capita and own calculations

### 3.2 Recession Phases

Firstly, we follow the method applied by Bushway et al. (2012) to analyze the cyclical behavior of crime and calculate the cumulated changes of the time series during a downswing from peak to trough. Here, each business cycle is treated as an independent experimental trial. In trials where the post peak rate of change exceeds the annual rate of change during the expansion a “plus” is given. A “minus” is given if the post peak rate of change is less than the annual rate of change during expansion. If the business cycle has no impact on the series we expect a 50 % probability (Bushway et al. (2012)) of both signs. The other test is a simple t-test of the hypothesis that the average of the growth rates of the respective time series is equal in recession and non-recession phases.

Table 5: Quality of Life Indicators in Up- and Downswings

Time series	Peak (P) to Trough (T) <sup>1</sup>					Non-- Para- metric test	Parame- tric test
	1973 (P) - 1975 (T)	1979 (P) - 1983 (T)	1991 (P) - 1993 (T)	2000 (P) - 2004 (T)	2007 (P) - 2009 (T)		
Real GDP per capita	4,92	5,25	-0,60	1,93	-3,66	5**	5,29***
Number of suicides	Na	Na	-9,43	-3,00	2,28	1	-0,90
Self-reported happiness	Na	-5,92	-0,33	10,22	-0,16	3	0,77
CO <sub>2</sub> emissions	-7,04	-10,87	-6,20	1,58	-5,79	3	2,41**
Persons in prison	-3,38	-14,24	5,40	4,84	-3,35	3	-0,03
Persons killed or injured in traffic	-6,32	0,26	-0,25	-12,82	-7,92	4	1,69*
Life expectancy	0,63	1,51	0,73	0,97	0,38	3	1,60
“Years Lost”	-4,51	-13,63	-5,86	-11,28	-3,59	2	0,12
Infant mortality	-10,15	-22,96	-9,23	-9,09	-2,70	3	-0,07
Overall mortality rate	3,28	0,00	-2,63	-2,94	2,97	2	-0,64
Bird Index	Na	Na	7,99	-10,8	Na	1	-0,24
Research and Development	Na	Na	1,63	9,11	8,71	2	0,94
Adjusted wage share	1,23	-1,74	1,06	-3,13	5,94	1	-2,17**
Progress index	6,67	16,67	9,46	12,0	-0,85	3	1,29
Index of Economic Well-Being	Na	Na	-0,24	2,16	2,60	1	0,82

Notes: “Non-parametric” test denotes a test following Bushway et al. (2012), testing whether the growth rate of the indicator is lower directly after a business cycle peak than the average growth rate of the upswing before. “Parametric test” denotes a t-test of the hypothesis for equal means of growth rates in recession areas and normal times. \*\*\*,(\*\*,\*) denotes rejection of the hypothesis at the 1 (5,10) % level.

<sup>1</sup> Cumulated change in %

Source: Own calculations.

As can be seen from Table 5 there is rarely a clear cyclical pattern in the variables. Rather, the development changes from cycle to cycle. This does hold, both for composite indices and series considered to be part of indicators sets. Moreover, tests of changes between the phases of the business cycle as defined by the turning points of the Economic Cycle Research Institute are conducted using the method by Bushway et al. (2012).

This task leads to the impression that there are hardly substantive dif-

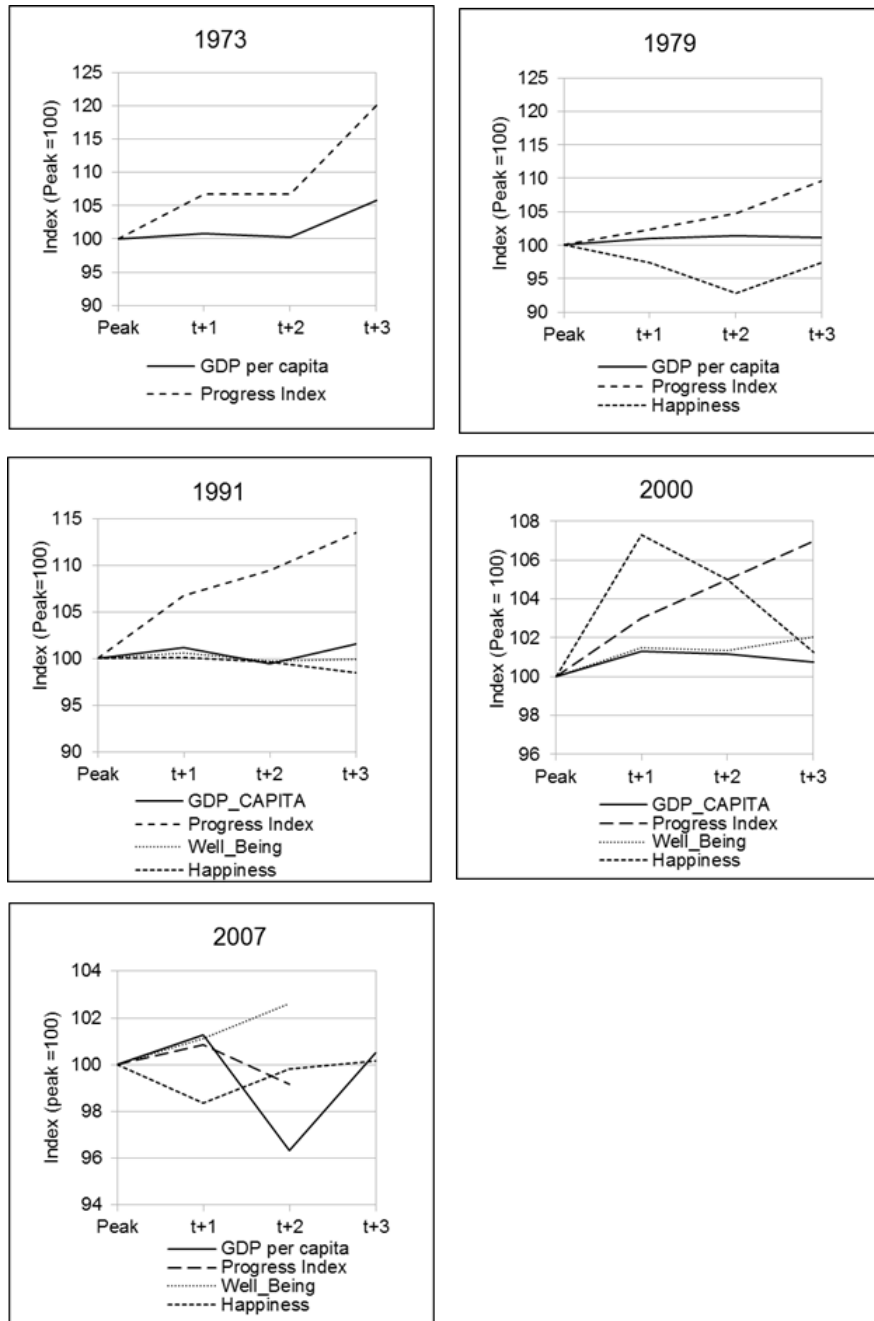


Figure 2: Selected Time Series after Business Cycle Peaks in Germany  
Source: See Table 4

ferences between recession phases and normal stances of the business cycle, if any at all. This view is further supported by Figure 2, which shows the development of selected time series after business cycle peaks (to avoid an overloaded figure, we restrict the exhibit to composite indices and subjective well-being, but the general conclusion does hold for the other series as well). It becomes apparent, that the changes relative to the level at the business cycle peak of alternatives to GDP tend to correspond to downswings of real GDP in a very limited way only. Sometimes, the indicators increase despite a pronounced recession.

### 3.3 Stylized facts: Volatility, Persistence and Correlation with GDP Measures

With the information at hand we calculate standard measures of business cycle stylized facts, namely the volatility of the time series measured by its standard deviation, the persistence of the series measured by its first order auto correlation coefficient and the correlation coefficient with respect to a reference series. The reference series in our case is either real growth of per capita GDP or the deviations from the smooth component of a Hodrick and Prescott (1997) (6.25) filter, respectively.<sup>2</sup> The results of this task are given in Table 6.

As it is also visible in Figure 3 the time series show very distinct patterns. To have an impact on cycles in welfare as compared to cycles in real GDP per capita, one would expect the indicator to be more volatile than real GDP and show a cyclical correlation with the standard measures of economic activity. By contrast, time series that would not alter our view on cyclical changes in welfare as compared to real GDP measures should not show (pro- or counter-) cyclical behavior with respect to the cycle of real GDP or a negligible volatility. Thus, we can group the quality of life indicators under investigation here in the following categories:

- Series in the North-East quadrant of the exhibit will correlate positively with GDP and by the same time show a high relative volatility. Adding such a series to GDP or replacing GDP by such a series will amplify welfare losses due to business cycles.
- Series in the South-East quadrant show also a high relative volatility, but tend to correlate negatively with GDP. Such series as complements

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<sup>2</sup>The source of the data for real GDP and population for a broad group of countries is Penn World Table 8.0 (see Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2013))



Table 6: Stylized Facts at the Business Cycle Frequency for Selected Variables

Time series	Relative Volatility	Persistence	Correlation with real GDP		
			t+1	t	t-1
Based on Changes over previous year					
Real GDP per capita	1,00	0,07	0,06	1,00	0,06
Number of suicides	1,67	0,11	-0,19	-0,14	-0,27
Self-reported happiness <sup>a</sup>	0,05	-0,43	0,13	0,14	0,12
CO <sub>2</sub> emissions	1,58	-0,04	-0,19	0,30*	0,31*
Persons in prison	2,17	0,44	-0,10	0,02	0,06
Persons killed or injured in traffic	2,47	-0,03	0,12	0,23	0,27*
Life expectancy	0,09	-0,25	-0,01	0,33**	0,10
Infant mortality <sup>a</sup>	1,00	0,73	-0,08	-0,29**	-0,13
“Years Lost”	1,50	-0,03	-0,17	0,10	0,04
Overall mortality rate <sup>a</sup>	0,10	-0,25	-0,05	-0,01	-0,10
Bird Index	3,74	-0,21	0,09	-0,48**	-0,05
Research and Development	1,56	0,30	0,00	0,27	0,37**
Adjusted wage share <sup>a</sup>	0,44	0,18	-0,17	-0,51***	0,14
Progress Index	1,37	0,29	0,25	0,34**	0,27*
Index of Economic Well-Being	1,52	-0,03	-0,01	-0,01	0,07
Based on deviations from smooth component of HP (6,25) filter					
Real GDP per capita	1,00	0,18	0,17	1,00	0,17
Number of suicides	1,50	0,16	-0,25	-0,26	-0,26
Self-reported happiness	0,04	-0,37	0,15	0,17	0,07
CO <sub>2</sub> emissions	1,49	0,11	-0,25	0,26	0,35**
Persons in prison	1,67	0,21	0,06	0,23	0,19
Persons killed or injured in traffic	2,26	0,03	0,15	0,41***	0,28*
Life expectancy	0,08	-0,21	0,07	0,45***	0,10
Infant mortality	0,46	-0,01	-0,05	-0,35**	0,04
“Years Lost”	1,32	-0,00	-0,18	0,08	0,10
Overall mortality rate	0,09	-0,22	-0,10	-0,10	-0,09
Bird Index	3,21	-0,22	0,09	-0,32	-0,11
Research and Development	1,39	0,28	-0,19	0,21	0,44**
Adjusted wage share	0,44	0,25	-0,36*	-0,68***	0,02
Progress Index	1,02	0,02	0,13	0,25	0,15
Index of Economic Well-Being	1,36	0,03	0,06	-0,03	0,00

Notes: (\*\*\*, \*\*, \*) denotes rejection of the hypothesis of a zero correlation coefficient at the 1 (5,10) % level.

<sup>a</sup> Time series measured in index points rather than in growth rates.

Source: Own calculations.

or substitutes to GDP will tend to show lower welfare costs of business cycles or show a counter-cyclical pattern compared to the one visible in the GDP figures.

- All series in the Western quadrant show a lower relative volatility as compared to GDP and will, therefore, show hardly any pronounced cycle at all.

Given these results, it is unlikely that a composite index will show cyclical behavior at all. This is also what we find for the suggested composite indices with enough time series data at hand which supports the argument for usage of indicator sets.

## 4 Cross-section and Quasi-Panel Evidence for Composite Indices

For practically all composite indicators designed to substitute GDP as a proxy for overall welfare, the lack of available data rules out a time series analysis of its properties. Hence, to discuss the link between conventional measures of the business cycle and alternative indicators we refer to a cross-sectional regression. Basically, we follow the footsteps of Wolfers (2003) and Di Tella and MacCulloch (2006) who discuss the macroeconomic factors explaining happiness data. Due to the lack of data, we refer to different types of data in estimating this equation. We use pure cross-section data for most of the alternative measures except the HDI. The basic approach takes the form:

$$I_i = \beta_0 + \beta_1 \ln(GDP_i) + \beta_2 GAP_i + \epsilon_i \quad (1)$$

The results in Table 7 reveal, however, almost no impact of the cyclical situation in a country on its welfare. To take into account as many countries as possible we use the deviation of real GDP (obtained from the IMF World Economic Outlook database) from the smooth component of a Hodrick and Prescott (1997) (6.25)filter as a measure of the Output gap.<sup>3</sup>

The coefficient of the Output gap is not significantly different from zero for any indicator and of a very small magnitude. These results hold even

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<sup>3</sup>We have also estimated equations using the Output gap estimate of the IMF. The results are not presented in this paper, but available upon request. The results are similar to the results presented here.

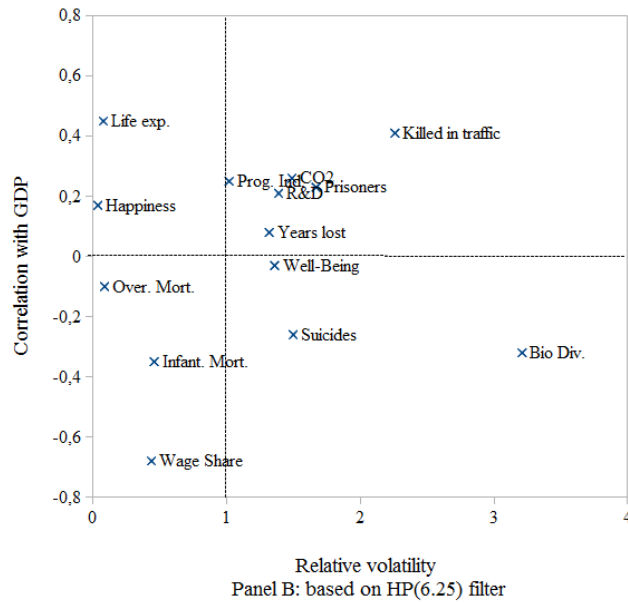
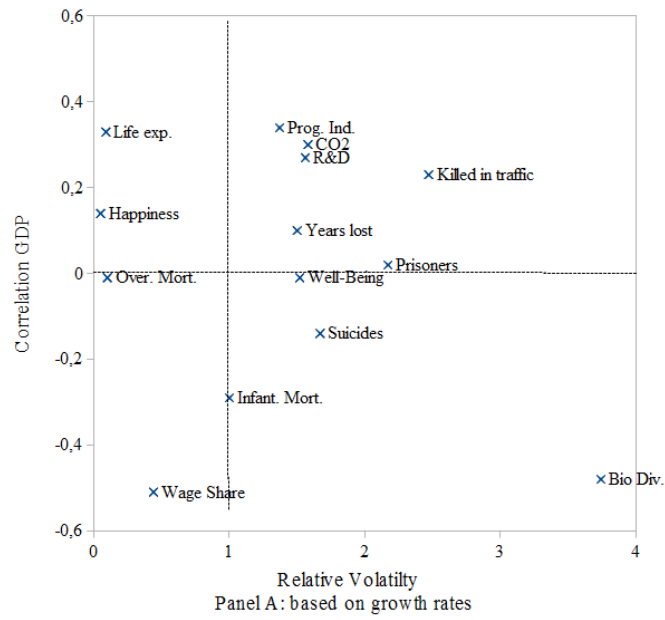


Figure 3: Relative Volatility and Correlation with GDP of Selected Time Series  
Source: See Table 6

when we do not control for the level of real GDP <sup>4</sup>. The econometric tests point to miss-specification in some cases. However, closer examination of the results reveals that possible non-itineraries as indicated by the RESET-test or outliers that may have defected the normality of the residuals have no impact on the coefficient of interest here.

Table 7: Cross-section Estimates of the Impact of GDP and Cyclical Indicators on Alternative Welfare Measures

	Progress index (2009)		Happy Planet Index (2012)		Index of Social Well-Being (2011)		Sustainable Government Index (2012)		Social Progress Index (2011)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Constant	-2,833 (1,28)**	-2,805 (1,347)*	32,70 (5,35)**	33,65 (5,46)**	-2,512 (1,66)	-3,127 (1,86)	-8,938 (4,08)**	-9,005 (4,25)**	-13,88 (2,94)**	-12,14 (2,68)**
GDP	0,376 (0,12)**	0,372 (0,13)**	1,048 (0,59)*	0,923 (0,61)	0,300 (0,16)**	0,355 (0,18)*	1,554 (0,41)**	1,562 (0,41)**	7,134 (0,33)**	6,957 (0,31)**
Output gap		-0,01 (0,11)		-0,30 (0,46)		-0,01 (0,01)		-0,001 (0,13)		0,11 (0,43)
$n$	22	21	141	134	13	12	30	29	45	41
Adj. $R^2$	0,32	0,29	0,02	0,01	0,30	0,31	0,39	0,37	0,88	0,87
Test for normality	0,58	0,51	0,38	0,38	0,02	0,02	0,99	0,98	0,04	0,08
Test for het- eroskedasticity	0,55	0,57	0,80	0,72	0,49	0,09	0,57	0,11	0,37	0,28
RESET test	0,05	0,08	0,00	0,00	0,00	0,11	0,03	0,04	0,17	0,07

\*,(\*\*) denotes significance at the 10 % (5 % ) level. Standard errors in brackets are calculated with a robust covariance matrix using the White method (see Cottrell (2014) for details). The numbers with regard to the tests for normality, heteroskedasticity, and the RESET test for miss-specification show p-values.

Source: Own calculations.

We also estimate an equation considered by Wolfers (2003) in a cross-country panel approach. Here, we are – die to the lack of data – restricted to cross-section estimation with just a few data points. It might nevertheless be helpful to have a quick look at the data. Hence, we estimate the equation:

<sup>4</sup>We have also estimated the equation by means of a robust estimator, namely the least absolute deviation estimator. The results – not presented in this paper, but available upon request from the authors – also show very small coefficients for the Output gap and no statistical significance.

$$I_i = \beta_0 + \beta_1 \text{Inf}_i + \beta_2 \text{UR}_i + \epsilon_i \quad (2)$$

where  $UR$  denotes the unemployment rate and  $Inf$  the inflation rate of the respective country<sup>5</sup>. The results of this task are given in Table 8. It turns out that the impact of an increase of either inflation or unemployment on economic welfare as measured by the respective measures is rather limited. In two cases, the coefficient of the unemployment rate is statistically different from zero, but of a very small, arguably negligible, magnitude. A coefficient of 0.01 for the unemployment rate in the case of the PI, for example, implies that even a doubling of the unemployment or inflation rate would reduce the index by far less than one standard deviation. The only estimation of a noteworthy magnitude is the negative impact of inflation on the Social Progress Index. Thus, if one follows the interpretation of Wolfers (2003), one would be forced to conclude that the welfare effects of business cycles are very small.

Table 8: Cross-section Estimates of the Impact of the Unemployment Rate and Inflation Rate on Alternative Welfare Measures

	Progress index (2009)	Happy Planet Index (2012)	Index of Social Well-Being (2011)	Sustainable Govern- ment Index (2012)	Social Progress Index (2011)
Constant	1,194 (0,06)**	46,98 (1,85)**	0,743 (0,04)**	7,742 (0,46)**	59,21 (2,31)**
Unemployment rate	-0,015 (0,006)**	-0,282 (0,175)	-0,016 (0,003)**	-0,083 (0,055)	-0,319 (0,191)
Inflation rate	-0,008 (0,020)	0,052 (0,191)	0,004 (0,019)	-0,061 (0,087)	-0,998 (0,236)**
$n$	22	98	13	30	36
Adj. $R^2$	0,07	0,01	0,52	0,08	0,236
Test for normality	0,13	0,85	0,62	0,41	0,12
Test for heteroskedasticity	0,18	0,20	0,44	0,31	0,24
RESET test	0,42	0,06	0,64	0,31	0,96

\* (\*\*) denotes significance at the 10 (5) % level. Standard errors in brackets are calculated with a robust covariance matrix using the White method (see Cottrell (2014) for details). The numbers with regard to the tests for normality, heteroskedasticity, and the RESET test for miss-specification show p-values.

Source: Own calculations.

The HDI provided by the United Nations is arguably the most frequently

<sup>5</sup>The data for both the inflation rate and the unemployment rate are taken from: IMF (2013)

noticed alternative measure in the sphere of politics. Here, we use so called “Quasi-panel-data” which in our case is data collected every five years for a given cross-section of countries. In this case, we estimate the equation:

$$HDI_{i,t} = \beta_{0,i} + \beta_1 \ln(GDP_{i,t}) + \beta_2 GAP_{i,t} + \epsilon_{i,t} \quad (3)$$

Where the subscript  $t$  stands for data points available every five years and  $i$  for the country under investigation. As the indexed constant makes clear, we estimate a fixed effects model. Furthermore, additional to controlling for the logarithm of real GDP per capita we also control for time fixed effects in some specifications. Basically, we refer to the often found results that the HDI is well correlated with the log of real GDP per capita and follows a pattern of diminishing marginal utility of real income (see Stanton (2007) for an overview on the discussion). The cyclical situation in such an equation would then explain the deviation from that relationship.

We achieve the same result with the cross-section estimates given in Table 9. In all specifications, the impact of a measure of the cyclical situation (in our case, the Output gap estimate provided by the IMF) has no impact on welfare as measured by the HDI of economically meaningful magnitude. If one follows Wolfers (2003) this would imply very low, if any, welfare costs of business cycles. This means that downswings of the economy would have no impact on the welfare. We doubt that this implication is intended or even noticed by the constructors of the alternative measures.

Table 9: Quasi-panel Estimates of the Impact of the Output Gap on the HDI

Dependent variable: Human Development Index (HDI)						
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.002 (0,08)	0,250 (0,06)**	0,825 (0,00)**	0,755 (0,01)**	0,029 (0,03)**	0,263 (0,07)**
Log of GDP per capita	0,082 (0,01)**	0,052 (0,01)**			0,080 (0,01)**	0,051 (0,01)**
Time fixed effects	No	Yes	No	Yes	No	Yes
Output gap			-0,004 (0,00)	-0,001 (0,00)	-0,004 (0,00)**	-0,002 (0,00)
$n$	181	181	173	173	173	173
Adj. $R^2$	0,42	0,62	-0,06	0,44	0,41	0,60

Notes: Standard error in brackets. (\*, \*\*) denotes significance at the 10 (5) % level. Standard errors in brackets are calculated with a robust covariance matrix using the White method. See Cottrell (2014) for details.

Source: own calculations.

## 5 Conclusion

Recently, alternative indicators to real GDP per capita have found wide interest in the economic policy debate. As Morgenstern (1965) argues, economic data is collected to support economic decisions. Therefore, it is a legitimate question, whether the “beyond GDP” figures (alternative progress measures) provide a consistent and plausible picture at business cycle frequencies to judge the current state of the economy. Public opinion and scientific literature both show a wide range of views on the topic, ranging from the notion that recessions are good things after all (see i.e. Paech (2009) to the statement that “austerity kills” (Stuckler and Basu (2013)).

We argue that alternative measures are not well enough developed to guide decisions in macroeconomic policy. First, we gave an overview of the growing body of composite indices and quality of life indicators calculated and found that the underlying data lacks quality, timeliness and are not provided at an adequate frequency even for EU or OECD countries (see also SVR/CAE (2010)). Moreover, it is often unclear, to which year a certain number refers. This is the case for the composite indices - which are mostly transparent on their data use - but their use of data of different years from various (mostly) official statistics is at least questionable. Second, we document, that, at least in Germany, a good deal of the data shows either no cycle at all, is very noisy or shows no clear-cut cyclical behavior at all. Additionally, the correlation between possible parts of a composite indicator is often negative. Hence, there is a substantial probability that cyclical developments for single series cancel each other out, so that composite indices will end up with no cycle at all.

Within the discussion on quality of life indicators these findings will provide an argument for indicator sets rather than composite indices. This means indicators which represent certain welfare dimensions like social affairs, environment or subjective well-being could be consulted to support decision making in economic policy. One of the obstacles for the usage of these indicators is the lack of data availability. Besides it is difficult to identify the right representatives for the welfare dimensions which fulfill given requirements. More generally, we also argue that the aggregation and weighting problem when it comes to building of composite indicators is not solved yet. The used methods appear to be rather arbitrary.

Furthermore, we exploit information available from several cross-sections of countries to analyze the impact of the Output gap on the alternative measures. Generally, we find no economically important impact of the Output gap at all. If one follows the argumentation by Wolfers (2003) for happiness data, this would imply almost no welfare cost of business cycles. We

find this rather implausible and doubt whether the proponents of alternative measures are aware of this implication of their calculations.

To sum up, our attempt to take alternative measures “beyond GDP” at face value and ask whether they can provide us with information on welfare changes induced by cyclical fluctuations leads us to conclude that the suggested measures still have a very long way to go to guide policy decisions in this area. Of course, we recognize that these indicators are not made to measure business cycle in the first place. Still, their proponents must explain what other economic decisions can be supported by alternatives to GDP.



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