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## GENERAL & APPLIED ECONOMICS | LETTER

# Decomposing the misery index: A dynamic approach

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**Abstract:** The misery index (the unweighted sum of unemployment and inflation rates) was probably the first attempt to develop a single statistic to measure the level of a population's economic malaise. In this letter, we develop a dynamic approach to decompose the misery index using two basic relations of modern macroeconomics: the expectations-augmented Phillips curve and Okun's law. Our reformulation of the misery index is closer in spirit to Okun's idea. However, we are able to offer an improved version of the index, mainly based on output and unemployment. Specifically, this new Okun's index measures the level of economic discomfort as a function of three key factors: (1) the misery index in the previous period; (2) the output gap in growth rate terms; and (3) cyclical unemployment. This dynamic approach differs substantially from the standard one utilised to develop the misery index, and allow us to obtain an index with five main interesting features: (1) it focuses on output, unemployment and inflation; (2) it considers only objective variables; (3) it allows a distinction between short-run and long-run phenomena; (4) it places more importance on output and unemployment rather than inflation; and (5) it weights recessions more than expansions.

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### PUBLIC INTEREST STATEMENT

The Great Recession has refocused the attention of macroeconomists on the determinants of business cycles, as well as on the consequences of recession on individual and community well-being. Originally proposed by Arthur Okun, the misery index (the unweighted sum of the unemployment and inflation rates) was probably the first attempt to develop a single statistic to measure the level of a population's "economic malaise". In this paper, we rewrite the misery index in order to improve its ability to track the state of health of the macroeconomy, without losing the clarity and conciseness of Okun's original intuition. Specifically, we develop a new approach in order to decompose the misery index into its main determinants. This "new misery index" focuses especially on unemployment and growth.

## 1. Introduction

Following the well-publicised financial crisis that began in 2007, many of the world's most advanced economies experienced one of the longest and deepest recessions recorded. In the USA, the Great Recession, as it has come to be known—officially began in December 2007 and ended in June 2009—was the largest macroeconomic downturn since the Great Depression of the 1930s. This set of largely unpredicted and dramatic events refocused the attention of macroeconomists on the determinants of business cycles as well as on the consequences of recessions on individual and community well-being (Grusky, Western, & Wimer, 2011).

Also known as Okun's misery index, the "Economic Discomfort Index" (EDI) probably formed the first attempt to summarise a range of macroeconomic indicators into a single statistic in order to track the state of health of the macroeconomy during the business cycle. In its original version, the misery index combines two fundamental targets of macroeconomic policy (unemployment and inflation) in a basic aggregate disutility function. This function measures the level of economic discomfort as the unweighted sum of unemployment and inflation rates (Mankiw, 2010).

Albeit remarkably simple, the intuition underlying the EDI has been developed in different useful ways (Blanchflower, Bell, Montagnoli, & Moro, 2013; Setterfield, 2009). In this letter, we offer a new approach to compute the misery index. Specifically, we attempt to rewrite the EDI by using two basic macroeconomic tools: the expectations-augmented Phillips curve and Okun's law. The aim of this work is to show a simple way to decompose the misery index, in order to improve Okun's original idea without losing its simplicity.

The remainder of the paper is structured as follows. In Section 2, we briefly review the history of the EDI. In Section 3, we try to reformulate the misery index. In Section 4, we discuss some interesting properties of the new index. Finally, Section 5 concludes the paper.

## 2. A short history of the misery index

The EDI was invented by economist Arthur Okun<sup>1</sup> in the early 1970s, when the United States began experiencing a combination of both increasing unemployment and increasing inflation (the so-called "stagflation"). Because both inflation and unemployment impose significant costs, the index was suggested by Okun as a means of providing a simple yet objective measure of "economic malaise". A higher level of either of these variables has negative effects on national welfare. Therefore, the EDI can be considered as a reverse measure of economic well-being (Nessen, 2008).

Calculated on either a quarterly or an annual basis, the EDI in period  $t$  ( $m_t$ ) is simply the sum of the current unemployment rate ( $u_t$ ) and the current inflation rate ( $\pi_t$ ):

$$m_t = u_t + |\pi_t| \quad (1)$$

where  $\pi_t$  is measured by the rate of change of the consumer price index, and is expressed as an absolute value, recognising that deflation may be as harmful as inflation (Lovell & Tien, 2000).

The index rapidly gained a degree of notoriety following a key article in *The Wall Street Journal*:

... a year like 1970 is difficult to sum up—you wish for one number that would tell all. Although it can be criticized as whimsically simplistic, there is such as index [...]. Mr. Okun constructs a "discomfort factor" for the economy. It is derived by simply lumping together the unemployment rate and the annual rate of change in consumer prices—apples and oranges, surely, but it is those two bitter fruits which feed much of our economic discontent [...]. The higher this index, the greater the discomfort—we are less pained by inflation if the job market is jumping, and less sensitive to others' unemployment if a placid price level is widely enjoyed ... (Janseen, 1971)

and then it received popular attention when used as a campaign tool, especially during the US presidential elections of the 1970s and 1980s.

In particular, in his 1976 presidential campaign, Jimmy Carter referred to Okun's macroeconomic indicator as an index of "economic misery", using it to argue against the economic policies of presidential incumbent Gerald Ford. The so-called misery index received further significant public attention and eventually became popular during the second 1980 presidential debate, when Governor Ronald Reagan—wrongly—attributed the index to Carter, using it to criticise the Carter administration's economic policy:

... when he was a candidate in 1976, President Carter invented a thing he called the misery index. He added the rate of unemployment and the rate of inflation, and it came, at that time, to 12.5 under President Ford. He said that no man with that size misery index has a right to seek re-election to the Presidency. Today, by his own decision, the misery index is in excess of 20, and I think this must suggest something. (Reagan, 1980)

Since its formulation, the evolution of Okun's misery index over the prior presidential term has often been used to presage the election outcome (Susino, 2012) as well as to provide some information about the presidential approval rating (Kleykamp, 2003).

At first glance, Okun's approach seems to be overly simplistic: it takes into account only two aspects of a country's economic performance and it weights the unemployment rate and the inflation rate equally. These criticisms can create the temptation to reject the index *in toto*, as a rough and excessive simplification. On the contrary, the EDI remains a useful basic tool for two main reasons.

First, the misery index seems to provide a useful approximation of the influence of macroeconomic conditions on population well-being, as measured by specific indicators such as consumer sentiment (Lovell & Tien, 2000), the crime rate (Lean & Tang, 2009), the poverty rate (Lechman, 2009) and even the suicide rate (Yang & Lester, 1992), among others.

Second, and more importantly, the misery index has turned out to be an insightful idea. Further research has extended the EDI along two, partially overlapping, paths. On the one hand, authors such as Barro (1999) and Hufbauer, Kim, and Rosen (2008) have attempted to improve the original index by including more indicators of the state of health of the macroeconomy (e.g. the GDP growth rate, the real long-term interest rate, the house and share prices, and so forth). This idea of an "augmented misery index" has been further developed by adding (and weighting) new variables to obtain a full composite indicator of a country's macroeconomic performance (Setterfield, 2009). On the other hand, the EDI served as a starting point in applied research on the "macroeconomic loss function" (Mayer, 2003). Motivated by the misery index, the pioneering studies by Di Tella, MacCulloch, and Oswald (2001) and Welsh (2007), among others, investigated the relation between macroeconomic performance and subjective well-being in an attempt to develop a reliable social welfare function that might be used to evaluate the effects of shocks and policies on population well-being (Blanchflower et al., 2013).

### **2.1. An alternative approach to compute the misery index**

A somewhat different use for the EDI is the analysis of the "optimal levels of inflation and unemployment" (Golden, Orescovich, & Ostafin, 1987, 1990; Yang, 1992; Zaleski, 1990). This approach involves a distinction between the actual and natural rates of unemployment (Wiseman, 1992). The attempt in what follows is to develop these insights by using the expectations-augmented Phillips curve and Okun's law.

As is well known, the aggregate supply function can also be expressed as a relation between unanticipated inflation (i.e. the difference between actual ( $\pi_t$ ) and expected inflation ( $\pi_t^e$ )) and cyclical unemployment, as follows:

$$\pi_t - \pi^e = -\alpha(u_t - u_n) \quad (2)$$

where  $\alpha$  is a constant that measures the change in  $\pi_t - \pi^e$  associated with a 1-unit change in the difference between actual ( $u_t$ ) and natural unemployment ( $u_n$ ) (Abel, Bernanke, & Croushore, 2008). When the rate of inflation is low and relatively stable—as in the case of today’s US and many other high-income economies—the expected inflation rate may reasonably be approximated by the inflation rate in the previous period ( $\pi_{t-1}$ ). Thus, the equation for the expectations-augmented Phillips curve becomes (Blanchard, 2011):

$$\pi_t - \pi_{t-1} = -\alpha(u_t - u_n) \quad (3)$$

Finally, by adding  $\pi_{t-1}$  to both sides of Equation 3, we obtain a simple expression for the inflation rate in period  $t$ :

$$\pi_t = \pi_{t-1} - \alpha(u_t - u_n) \quad (4)$$

In other words, given the parameter  $\alpha$ , current inflation depends on past inflation and on the deviations of unemployment from its natural rate. This expression will replace  $\pi_t$  in the original misery index.

Turning our attention from inflation to unemployment, we introduce the statistical relation between changes in unemployment and changes in output growth. This is actually another influential contribution of Okun (1962). Several slightly different equations connecting the behaviour of unemployment and GDP during business cycle are commonly known as “Okun’s law” (Knotek, 2007). For the purposes of this note, we utilise a gap version of this law, which relates the change in the unemployment rate from period  $t$  to period  $t-1$  ( $u_t - u_{t-1}$ ) to the difference between actual ( $g_t$ ) and potential ( $g^*$ ) output growth, as follows:

$$u_t - u_{t-1} = -\beta(g_t - g^*) \quad (5)$$

where the coefficient  $\beta$  measures how quickly deviations from the “normal” rate of growth are translated into changes in the unemployment rate (Blanchard, 2011). Again, if we add  $u_{t-1}$  to both sides of Equation 5, we obtain a new expression for the unemployment rate in period  $t$ , as follows:

$$u_t = u_{t-1} - \beta(g_t - g^*) \quad (6)$$

where  $u_t$  is a function of the past rate of unemployment, minus some fraction ( $\beta$ ) of the difference between the rate of growth of effective and potential output. We will use this expression to replace  $u_t$  in the original misery index.

### 3. A reformulation of Okun’s misery index

By replacing both the inflation rate and the unemployment rate in the original misery index—Equation 1—with their expressions from Equations 4 and 6, respectively, we obtain a new formulation of Okun’s misery index, as follows:

$$m_t = u_{t-1} - \beta(g_t - g^*) + |\pi_{t-1} - \alpha(u_t - u_n)| \quad (7)$$

where the level of the population’s economic malaise, or discomfort, now depends explicitly on those underlying forces that drive the behaviour of unemployment and inflation during the course of the business cycle.

Let us consider, for instance, the US economy. Using the FRED (Federal Reserve Economic Data) database from the Federal Reserve Bank of St. Louis, we can easily compute both the original as well as the revised EDI<sup>2</sup>. In a year like 2008, for example, unemployment was 5.5% and inflation was 4.1%. By putting these numbers into Equation 1, such conditions produce a misery index of 9.6%. Equation 7 allows us to decompose this result into its main determinants, as follows:

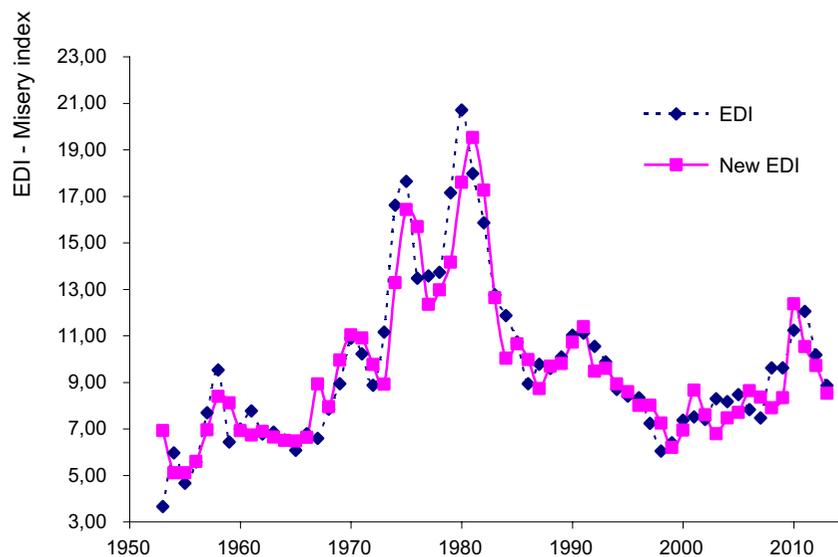
**Table 1. The “new misery index” in selected years (US economy, 1953–2013)**

	$u_{t-1}$	$g_t$	$g^*$	$u_{t-1} - \beta(g_t - g^*)$	$\pi_{t-1}$	$u_t$	$u_n$	$ \pi_{t-1} - \alpha(u_t - u_n) $	$m_t$
1955	5.6	7.13	3.21	4.03	0.36	4.4	5.38	1.08	5.11
1965	5.2	6.50	4.22	4.29	1.32	4.5	5.68	2.18	6.47
1975	5.6	-0.20	3.58	7.11	11.01	8.5	6.17	9.31	16.42
1985	7.5	4.24	3.36	7.15	4.37	7.2	6.02	3.51	10.65
1995	6.1	2.72	3.02	6.22	2.60	5.6	5.29	2.37	8.59
2005	5.5	3.35	2.37	5.11	2.67	5.1	5.00	2.59	7.71

Notes:  $\alpha = 0.73$  and  $\beta = 0.40$ .

Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis. Accessed November 13, 2014. <http://research.stlouisfed.org/fred2/>.

**Figure 1. Original and revised Okun’s misery index in the US economy (1953–2013).**



$$u_{1987} - \beta(g_{1988} - g^*_{1988}) + |\pi_{1987} - \alpha(u_{1988} - u_{n1988})| = m_{1988} \quad (8)$$

Specifically, if we set  $\beta = 0.40$  and  $\alpha = 0.73$  (Blanchard, 2011), Equation 8 gives:

$$6.20_{1987} - 0.40 \times (4.20_{1988} - 3.19^*_{1988}) + |3.58_{1987} - 0.73 \times (5.50_{1988} - 5.93_{n1988})| = 9.69_{1988} \quad (9)$$

In the same way, it is straightforward to calculate the level of economic discomfort in any one year (as shown in Table 1). The evolution of the original and the revised misery index in the US economy, over the period 1953–2013, is depicted in Figure 1.

According to Equation 7, for a given value of the parameters  $\alpha$  and  $\beta$ , the level of  $m$  in period  $t$  is a function of three key factors, namely: (1) the original misery index in the previous period (i.e. the sum of the unemployment and inflation rates at time  $t-1$ ,  $u_{t-1} + \pi_{t-1}$ ); (2) the output gap, in growth rate terms (i.e. the difference in the growth rate between actual and potential GDP,  $g_t - g^*$ ); and (3) cyclical unemployment (i.e. the difference between the actual rate and natural rate—or non-accelerating inflation rate—of unemployment,  $u_t - u_n$ ).

#### 4. Some features of the “new EDI”

It is worth noting some interesting properties of this reformulation of the EDI.

First, the new EDI takes into account the three essential phenomena first considered in verifying a country’s macroeconomic conditions: output, unemployment and inflation.

Second, given  $\pi_{t-1}$ , rising inflation only starts increasing the level of economic discomfort when the unemployment rate falls below its natural rate. That is, as measured by Equation 7, the output gap and cyclical unemployment are the crucial factors in determining the magnitude of economic misery.

Third, the reformulated EDI distinguishes between the trend and the cycle components of both the rate of growth of GDP and the unemployment rate. In other words, it breaks up the short-run and long-run determinants of the population's economic malaise.

Fourth, the weighting scheme for both the output gap and cyclical unemployment comes directly from the functioning of the economy, meaning that we are able to measure the parameters  $\alpha$  and  $\beta$  by estimating Okun's law and the Phillips curve, respectively. Thus, there is no need to infer  $\alpha$  and  $\beta$  by using subjective variables (e.g. individual opinions on personal happiness expressed in life satisfaction surveys).

Fifth, and finally, since the growth rate of potential GDP is typically greater than one, the negative impact of recessions on a population's economic well-being is always stronger than the positive impact of expansions, *ceteris paribus*.

## 5. Conclusions

Business cycles are complex phenomena, able to influence economic well-being in several different and interrelated ways. There are, however, some key variables (such as unemployment and inflation rates and the rate of growth of GDP) that play a fundamental role in determining national welfare. That is why Okun's original idea has been found to be a useful application in economics and political sciences.

This conceptual paper contributes to the literature on the misery index. Our approach, however, differs substantially from the standard one. Specifically, instead of incorporating new variables into the EDI or investigating the structure of individual preferences about inflation and unemployment, we rewrite the misery index by using the two basic relations of modern macroeconomics. This reformulation is closer in spirit to Okun's intuition, but offers an improved version of the misery index. In particular, regarding the effect of the macroeconomic conditions on a population's economic discomfort, this new misery index focuses on the output gap and cyclical unemployment, allows a distinction between short-run and long-run phenomena, places more importance on output and unemployment rather than inflation, is based only on objective variables and weights recessions more than expansions.

In a nutshell, reformulating the EDI by explicitly including the expectations-augmented Phillips curve and Okun's law is a fruitful way to improve Okun's original idea without any loss of clarity or conciseness.

### Supplementary Material

Supplementary material for this article can be accessed here <http://dx.doi.org/10.1080/23322039.2014.991089>.

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### Notes

1. Arthur Melvin Okun (November 28, 1928–March 23, 1980) was a professor at Yale University and then a fellow at the Brookings Institution in Washington, D.C. He also served as a member of President Lyndon B.

Johnson's Council of Economic Advisers (CEA) and as a Chairman of the CEA between 1968 and 1969 (Brookings Institution, 1980). Some of Okun's main contributions to modern macroeconomics theory and policy are now collected in Pechman (2004).

2. Table 1A in Appendix contains a short description and some basic descriptive statistics of all variables included in Equation 7. The complete database is available as supplementary material.

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**Appendix**

**Table 1A. Variables and descriptive statistics (USA, 1953–2013)**

Variable	Description	FRED code	Mean	Std. Dev.
<i>u</i>	Civilian unemployment rate (%)	UNRATE	6.0	1.6
<i>u<sub>n</sub></i>	Natural rate of unemployment (%)	NROU	5.6	0.4
<i>g</i>	Real GDP (% change from year ago)	GDPC96	3.1	2.2
<i>g*</i>	Real potential GDP (% change from year ago)	GDPPOT	3.2	0.7
<i>π</i>	CPI all urban consumers and items (% change from year ago)	CPIAUCSL	3.6	2.8

Data Source: FRED, Federal Reserve Economic Data, Federal Reserve Bank of St. Louis. Accessed November 13, 2014. <http://research.stlouisfed.org/fred2/>.

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