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## A NOTE ON MEASURING THE DEPTH OF MINIMUM WAGE VIOLATION

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## **A Note on Measuring the Depth of Minimum Wage Violation**

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### **Abstract**

In the empirical literature on minimum wage enforcement, the standard approach is to measure the number of violations, not their depth. In this paper we present a family of violation indices which, by analogy with poverty indices, can emphasize the depth of violation to different degrees. The standard measure is a special case of this family of indices, but other members of the family highlight the depth of violation. We present an application to South Africa to show that the depth of violation matters, and is not captured by the standard measure in actual situations.

**Key Words:** Minimum Wage, Depth of Violation, South Africa

**JEL Codes:** J38, O55

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## I. Introduction

Developing countries are notorious for poor labour market conditions (Ronconi, 2008). While most developing countries have extensive labour regulations and social security systems, compliance in the less developed world is generally low (Ronconi, 2008; Strobl & Walsh, 2003; Maloney and Nunez, 2003). There is a growing theoretical and empirical literature on the problem of non-compliance with minimum wage laws in developing countries (Basu, Chau and Kanbur, 2010; Andalón & Pagés, 2008). In the empirical literature, a standard way of measuring non-compliance is as the fraction of all covered workers whose wages are below the minimum. But this measure does not distinguish between different degrees of violation—for example, a wage just below the minimum is counted the same as a wage at one third of the minimum, surely an inexact way to measure a violation of regulation. In Section II this paper proposes a family of minimum wage violation indices which addresses this problem by appealing to the analogy with poverty indices. Section III applies these indices to South Africa and shows that the depth of violation matters. Section IV concludes.

## II. A Family of Violation Indices

In the enforcement literature, non-compliance is generally measured as the fraction of all covered workers whose wages fall below the minimum. However, this method of measuring compliance does not distinguish between different degrees of violation. For example, a wage just below the minimum is equivalent in violation to a wage at one third of the minimum. We propose here an index of violation to capture both the number of wage earners falling below the minimum and also how far below the minimum they fall.

Consider a distribution of actual wages  $F(w)$  with density function  $f(w)$ , and an official minimum wage  $w^m$ . If there is full compliance, strictly speaking, we should not see any wages at all below  $w^m$ . Since those who would otherwise pay wages below  $w^m$  have no reason to pay above  $w^m$  compliance means paying a wage  $w^m$ , and non-compliance is paying a wage strictly less than  $w^m$ . We define the measure of individual violation as

$$v = v(w^m, w) \tag{1}$$

where  $v$  is positive if and only if  $w$  is strictly less than  $w^m$ , and zero if  $w$  is equal to or greater than  $w^m$ . When  $w$  is strictly less than  $w^m$ ,  $v$  is weakly decreasing in  $w$  and weakly increasing in  $w^m$ . A particular functional form which satisfies these properties is

$$v = (w^m, w) = \left[ \frac{(w^m - w)}{w^m} \right]^\alpha \tag{2}$$

for  $\alpha$  greater than or equal to zero. In fact, when  $\alpha = 0$ ,  $v$  becomes an indicator function, taking on the value 1 when  $w$  is strictly less than  $w^m$ , and a value of 0 when  $w$  is greater

than or equal to  $w^m$ . When  $\alpha = 1$ ,  $v$  is the gap between the actual wage and the official minimum wage, expressed as a fraction of the minimum wage. For values of  $\alpha$  greater than 1, the violation function emphasizes large gaps more—a particular value of interest in empirical application will be  $\alpha = 2$  which simply squares the gap to produce a measure of the violation.

Having specified a measure of violation for an individual wage, the issue now is how to aggregate these individual violations, and how to normalize this aggregation. A straightforward method would be to simply take the expectation of  $v()$  over the entire wage distribution, defining overall violation  $V$  as:

$$V = E \{v(w^m, w)\} \tag{3}$$

with  $v(w^m, w)$  defined as (2) above,  $V$  becomes

$$V = E \left\{ \left[ \frac{(w^m - w)}{w^m} \right]^\alpha \right\} \tag{4}$$

This will be recognized immediately as the analogue of the Foster, Greer and Thorbecke (1984), “FGT” measure of poverty, with  $w^m$  acting as the poverty line and  $w$  as the income. In the poverty context, a higher  $\alpha$  captures greater “poverty aversion.” In our context, higher  $\alpha$  similarly captures “violation aversion”, emphasizing greater weight given to the worst violations. What difference is made by different degrees of violation aversion is an empirical question. We turn now to an application of the new measures of minimum wage violation to South Africa.

### III. Application to South Africa

The minimum wage debate is central to South African policy discourse. A detailed account of South African minimum wage institutions, and the relevant data sources for measuring violation, is provided in Borat, Kanbur and Mayet (2010). The Employment Conditions Commission (ECC) is a representative body within the Department of Labour (DoL) which advises the Minister of Labour on sectoral wage minima. The DoL uses a team of labour inspectors whose job is to enforce compliance with these sectoral determinations. There are 11 different sectoral determinations set by the ECC.<sup>1</sup> In this note we will focus on 9 of these sectors. The minima are further differentiated for some sectors by geographical area (urban-A; semi-urban-B and rural-C), and are regularly updated for inflation. For data on wages in South Africa we use the September Labour Force Survey (LFS) data for 2007. The sectoral and occupational codes in these data are matched with the gazetted minimum wages for different sectors to gauge the violation in each of the 9 sectors. A detailed

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<sup>1</sup> Specifically Forestry, Agriculture, Contract Cleaning, Children in the Performance of Advertising, Artistic and Cultural Activities (under fifteen years of age), Taxi Operators, Civil Engineering, Learnerships, Private Security, Domestic Workers, Wholesale and Retails, and Hospitality

discussion of this data source is provided in Borhat, Kanbur and Mayet (2010).<sup>2</sup> The estimates for  $V$  with  $\alpha = 0, 1$  and  $2$ , denoted  $V_0, V_1$  and  $V_2$ , are given in Table 1. Whilst  $V_0$  measures the percentage of workers violated, that is, earning below the minimum, the ratio ( $V_1/V_0$ ) allows for the interpretation of  $V_1$ , since it denotes the percentage shortfall of the average wage of violated workers from the minimum wage. Put differently, violated workers in this sample are earning on average ( $V_1/V_0$ ) below the relevant minima.

**Table 1: Estimates of the Index of Violation, 2007**

Sectoral Determination	Index of Violation			
	$V_0$	$V_1$	$V_2$	$V_1/V_0$
<b>Retail and Wholesale Domestic Workers</b>	0.39	0.14	0.07	0.36
<b>Farm Workers</b>	0.39	0.13	0.06	0.33
<b>Forestry Workers</b>	0.55	0.17	0.07	0.31
<b>Taxi Operators</b>	0.53	0.16	0.07	0.30
<b>Security Workers</b>	0.47	0.18	0.09	0.38
<b>Hospitality Workers</b>	0.67	0.28	0.14	0.42
<b>Contract Cleaners</b>	0.29	0.10	0.05	0.34
<b>Civil Engineering</b>	0.44	0.16	0.08	0.36
<b>Total</b>	0.09	0.04	0.02	0.44
	<b>0.45</b>	<b>0.16</b>	<b>0.08</b>	<b>0.36</b>

Source: Authors' calculations using LFS September 2007 (StatsSA) and ECC sectoral determinations.

The estimates in the last row of Table 1 show that in 2007 45% of employees were receiving sub-minimum wages. The violation rate varies from 67% for Security Workers to 9% for employees in civil engineering. But is the *depth* of violation uniform across these sectors? Table 2 suggests that it is not. In this Table the estimates for the three indices have been ranked, with a rank of 1 denoting the highest rate of violation. It can be seen that while the ranks are related, they are not perfectly correlated. For example, comparing  $V_0$  and  $V_2$ , Forestry Workers change rank from 3 to 6, Farm Workers change from 2 to 4, whilst taxi operators switch from being ranked 4<sup>th</sup> with  $V_0$  to being 2<sup>nd</sup> with  $V_2$ .

<sup>2</sup> The detailed paper also discusses how we use the 2000 Income Expenditure Survey (IES) to match geographical areas in the LFS to the geographical areas in minimum wage determinations.

**Table 2: Rank of the Index of Violation, 2007**

Sectoral Determination	Index of Violation		
	V <sub>0</sub>	V <sub>1</sub>	V <sub>2</sub>
Retail and Wholesale	6	6	5
Domestic Workers	7	7	7
Farm Workers	2	3	4
Forestry Workers	3	4	6
Taxi Operators	4	2	2
Security Workers	1	1	1
Hospitality Workers	8	8	8
Contract Cleaners	5	5	3
Civil engineering	9	9	9

Source: Authors' calculations using LFS September 2001 and 2007 (StatsSA) and ECC sectoral determinations.

These descriptions of rank changes are confirmed in Table 3. In 2007, the correlations between  $V_0$ ,  $V_1$ , and  $V_2$  are all high, but not perfect—the lowest value is around 77%. The high correlation coefficient between the rankings of the depth of violation,  $V_1$ , and the squared depth of violation,  $V_2$ , (at 0.99) is an unsurprising result, recalling that in the latter the individual measure of violation is simply the square of the former. But note that the correlation coefficient between the  $V_0$  and the  $V_1$  index is higher than that between the  $V_0$  and the  $V_2$  index, suggesting that the headcount of violated individuals and the degree of violation may be more closely related than the share of violations is with the degree of violation squared. The lower correlation between these two indices may reflect the fact that the changes in them are driven by different underlying factors. When severity of violation is strongly emphasized, some sectors stand out more sharply. The depth of violation matters.

**Table 3: Spearman's Rank Order Correlation Coefficients between Violation Indices, 2007**

Index	Coefficient
V <sub>0</sub> and V <sub>1</sub>	0.8071*
V <sub>0</sub> and V <sub>2</sub>	0.7667*
V <sub>1</sub> and V <sub>2</sub>	0.9865*

Source: Authors' calculations using LFS September 2001 and 2007 (StatsSA) and ECC sectoral determinations

Note: \* indicates significance at 1%.

#### IV. Conclusion

In the empirical literature on minimum wage enforcement, the standard approach is to measure the number of violations, not their depth. In this paper we present a family of violation indices which, by analogy with poverty indices, can emphasize the depth of violation to different degrees. The standard measure, the percentage of covered workers earning sub-minimum wages, is a special case of this family of indices, but other members of the family highlight the depth of violation. This family of measures can be estimated using the same data that is used to estimate the standard measure of violation. We have presented an application to South Africa to show that the depth of violation matters, and is not captured by the standard measure in actual situations. The new family of indices of minimum wage violation can play an important role in the growing literature on minimum wage enforcement since they are the first step in a richer causal analysis of what determines the patterns of minimum wage violation (Bhorat, Kanbur and Mayet, 2010).

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