

# **HDI and Standard of Living: A Panel Data Analysis of Latin America**

**Matthew Susich**

## **Abstract:**

This paper investigates the correlation between the Human Development Index and other significant measures of standard of living. The study incorporates data for upper- and middle-income countries in Latin America (Mexico, Costa Rica, Columbia, Peru, Uruguay, Brazil, Paraguay, Guatemala, Jamaica, Belize, and Bolivia) surrounding standard of living, including GDP per capita, public spending on education, public spending on health, GNI per capita, unemployment, infant mortality, and inflation. The conclusions from this study are drawn from regression analysis and tests of correlation between the Human Development Index and alternative measures of standard of living. The results show that unemployment and infant mortality are negatively correlated with HDI and statistically significant.

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Keywords: **Economic Development, General Welfare, Well-Being.**

<sup>a</sup> Department of Economics, Bryant University, 1150 Douglas Pike, Smithfield, RI02917. Phone: (401) 232-6379. Email: [msusich@bryant.edu](mailto:msusich@bryant.edu).

## 1.0 INTRODUCTION

The Human Development Index (HDI) is one of the most widely used economic measures of human development, overall welfare, and standard of living on a global scale. It is primarily a summary statistic that measures three main dimensions: health, education, and overall standard of living. HDI is mainly used to compare standard of living across countries. It is also considered a far more accurate and precise measure of standard of living and economic development than other measures, such as gross domestic product (GDP) per capita. However, measuring standard of living can be difficult because ultimately, it is complex and is the product of a large variety of factors. So, how well does the human development index measure human development and general well-being?

This study aims to test the accuracy of HDI as a development measure by analyzing its correlation with alternative measures of health, education, and overall standard of living. The HDI is a composite measure that uses health measures (life expectancy at birth and life expectancy index), education measures (expected years of schooling, mean years of schooling, and education index), and standard of living measures (GNI per capita and GNI index) to acquire a general understanding of a country's level of human development (Human Development Reports, 2022). Using the HDI measures of eleven upper/middle income Latin American countries over a 22-year period, this study will assess the accuracy of HDI by testing its correlation with alternative important measures of development and standard of living. Unemployment, inflation, and infant mortality are important measures of development and well-being but are not specifically captured by HDI.

This study is relevant because its conclusions have implications for how to assess the economic development of a country and the general welfare of its citizens properly and accurately. It will contribute to the understanding of economic and human development and how best to assess them. This study also aims to uncover the variables most strongly correlated with development and whether HDI provides a proper reflection. Furthermore, the findings and conclusions of this study have the potential to inform policy and development decisions for economic and governmental leaders in Latin America.

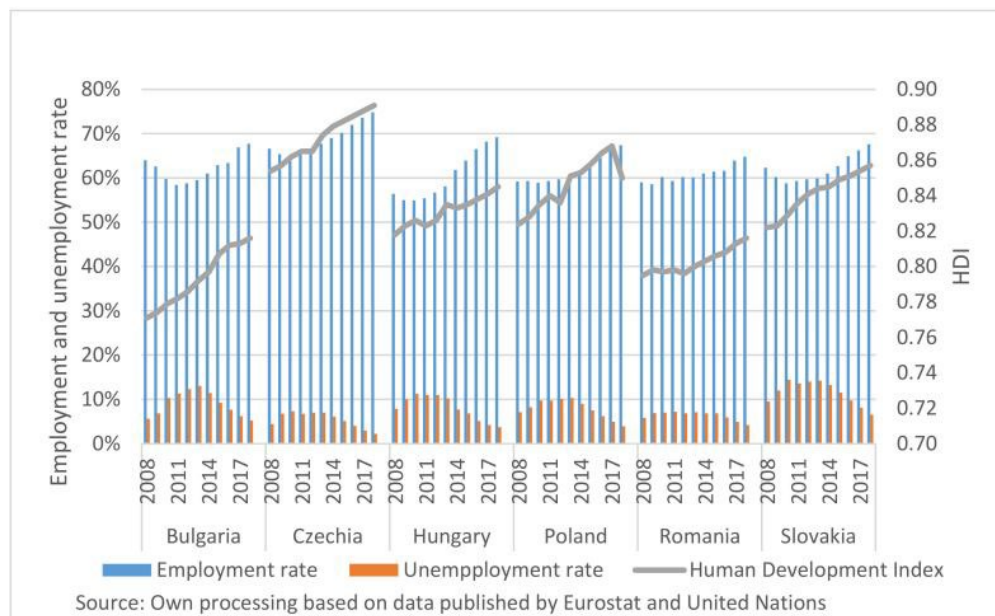
This paper was guided by three research objectives that differ from other studies: First it investigates the accuracy of HDI as a development measure; Second, it examines the impact of alternative development measures on HDI; Last, the study specifically examines upper/middle income Latin American countries and their development. There is very little empirical work in the literature concentrating on Latin American countries and the correlation between HDI and the aforementioned alternative variables. This paper successfully fills this void.

The rest of the paper is organized as follows: Section 2 discusses different trends surrounding HDI and its relationship to alternative variables. Section 3 gives a brief literature review. Section 4 outlines the empirical model and discusses data and estimation methodology. Finally, section 5 presents and discusses the empirical results. This is followed by a conclusion in section 6.

## 2.0 TREND

**Figure 1** shows the relationship between HDI and the employment rate and unemployment rate in Central and Eastern European countries. Based on this graph, the HDI value and employment rate seem to move in similar directions, while the HDI value and unemployment rate seem to move in opposite directions. This would indicate that the HDI accurately reflects development in terms of unemployment. In other words, the HDI decreases when unemployment is higher and increases when unemployment is lower.

**Figure 1: Employment rate, unemployment rate, and HDI**

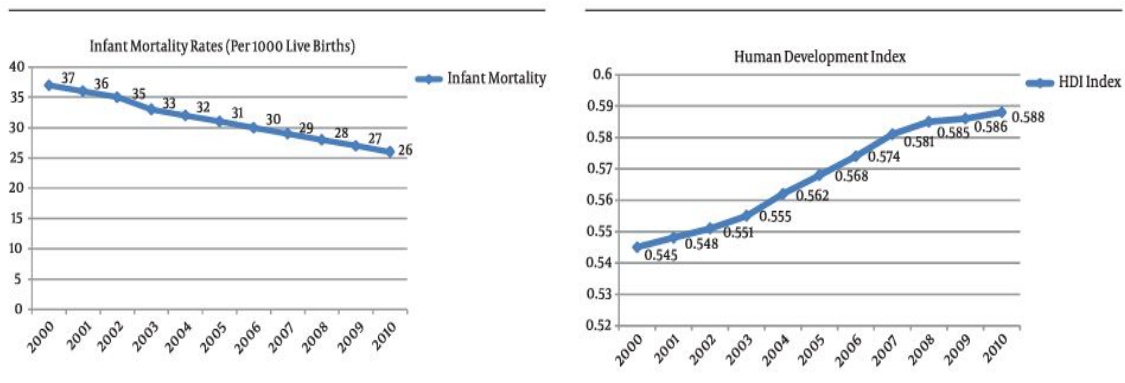


Source: (Popa, Jimon, David, & Sahlian, 2021)

**Figure 2** shows two separate graphs. The graph on the left shows the worldwide trend of infant mortality over ten years (2000-2010). The graph on the right shows the worldwide trend of HDI over the same ten-year period. Based on these graphs, it is evident that these two measures are moving in opposite directions. This would indicate that the

steady increases in overall HDI over time has reflected the decrease in overall infant mortality over that same period. In other words, these graphs indicate that HDI does indeed reflect changes in infant mortality, even though that measure is not directly used in the calculation of HDI.

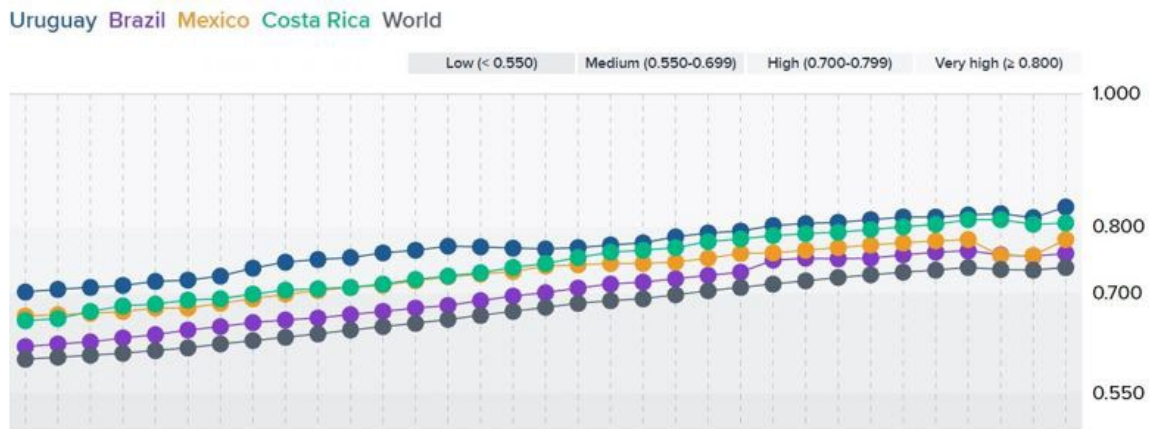
**Figure 2: Trend in the Infant Mortality Rate and HDI 2000-2010**



Source: (Alijanzadeh, Asefzadeh, & Zare, 2016)

**Figure 3** shows the trend of HDI in 4 of the upper/middle-income countries in Latin America (Brazil, Mexico, Costa Rica, and Uruguay) compared to the world average for 1990-2021. For all 4 countries and the world average, the graph shows a slight increasing trend over time. It also shows that all the countries have had higher HDI values than the world average over the 21-year period.

**Figure 3: Trend in HDI for Mexico, Brazil, Uruguay, and Costa Rica 1990-2021**



Source: (Human Development Reports, 2022)

### 3.0 LITERATURE REVIEW

There have been a number of studies related to the examination of the Human Development Index (HDI) as a measure of standard of living, quality of life, and overall welfare. Most of this research was focused on correlational studies between HDI and alternative measures of standard of living. A study by Elistia and Syahzuni (2018) concluded that there was a significant correlation between human development and economic growth, as measured by GDP per capita. Furthermore, a cross-country regression analysis conducted by Shah (2016) also found that there was high correlation between HDI and other welfare measures, such as GDP per capita, literacy rate, life expectancy at birth, Gini index, etc. The author of this study also contended that improvements in education, health, and income are the best means of improving overall human development (Shah, 2016). Furthermore, Alijanzadeh et al. (2016) also found a negative correlation between infant mortality and a number of welfare indicators, including HDI, GDP per capita, and life expectancy. Priambodo (2020) found that unemployment and poverty had a negative effect on HDI, while Ogbemor et al. (2020)

found that inflation had both a negative and significant impact on standard of living in Nigeria.

However, a study by Sinaga (2020) that investigated the impact of a variety of independent variables on poverty found that HDI had a negative but insignificant impact on poverty. Binder and Georgiadis (2011) found that the development of HDI in a particular country can be drastically different than changes in that country’s GDP. Conversely, Kula et al. (2010) found that health spending as a percentage of GDP was positively correlated with measures of happiness in a given country. This suggests that the allocation of funds as a percentage of GDP has a greater impact on standard of living than the level of GDP itself.

#### **4.0 DATA AND EMPIRICAL METHODOLOGY**

##### **4.1 Data**

The study uses annual panel data from 2001 to 2021. Data was obtained from the World Bank website World Development Indicators. Data was also obtained from the Human Development Reports website surrounding the Human Development Index. The data includes 7 independent variables for 11 Latin American countries over a 22-year period. The summary statistics for the data can be found in Table 1.

**Table 1: Summary Statistics**

<b>Variable</b>	<b>Observations</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
HDI	242	0.7176	0.0549	0.556	0.83
GDP	242	4412520	8456926	2599.186	3.25e+07
GNI	242	4201070	8068279	2534.837	3.13e+07
EDU	242	4.6925	1.4246	2.0682	8.4371
HEA	242	3.6376	1.2608	1.4673	6.5674
UNEMP	242	7.0465	3.4690	1.902	16.661
INF MORT	242	17.5984	8.4312	5	53.1
INFLAT	242	5.3827	3.6023	-7.1138	22.0228

## 4.2 Empirical Model

Following Mpofu (2013), this study adapted and modified their econometric model used to analyze the impact of different variables on HDI in South Africa. This study adds to this model by including alternative measures, such as unemployment, inflation, and infant mortality, to test their impact on HDI in 11 Latin American countries.

The model could be written as follows:

$$\ln(HDI) = \beta_0 + \beta_1(\ln(GDP)) + \beta_2(\ln(EDU)) + \beta_3(\ln(HEA)) + \beta_4(\ln(GNI)) - \beta_5(UNEMP) - \beta_6(INF MORT) - \beta_7(INFLAT) + \varepsilon$$

*HDI* is a country's human development index score. It is a composite statistic that measures a country's human development based off of its citizens' ability to have a long and healthy life, knowledge, and a decent standard of living (Human Development Reports, 2022). *HDI* is one of the most widely used measures of a country's economic and human development. In this model, *HDI* will act as the dependent variable in order to test each of the variables impact on it as well as to test the accuracy of *HDI* as a development and standard of living measure. The definition of *HDI* is consistent with Human Development Reports definition of *HDI* (Human Development Reports, 2022).

The independent variables for this model consist of seven variables obtained from various sources. Appendix A provides descriptions, expected signs, and justifications for using the variables. First, *GDP* represents the gross domestic product per capita of the given country. *EDU* represents the country's level of general expenditure on education as a percentage of that year's gross domestic product. Similarly, *HEA* represents the country's general expenditure on health as a percentage of that year's gross domestic product. *GNI* represents the country's gross national income



per capita of the given country. Furthermore, *UNEMP* is the percentage of the country's labor force that is unemployed for that year. *INF MORT* is the number of infant deaths per 1,000 live births. Finally, *INFLAT* represents the percentage increase or decrease in consumer prices for that year. The *GDP*, *GNI*, *EDU*, and *HEA* variables were logarithmically transformed to follow with the study that this model is based on and to see the percentage increase of HDI as a result of a 1% increase in the dependent variables from the regression. The other independent variables were not logarithmically transformed in order to test the impact of a one unit increase in the variable on HDI.

## 5.0 EMPIRICAL RESULTS

The empirical estimation results are presented in Table 2. The empirical estimation shows the relationship between the HDI value and the measures of standard of living included in the model for the eleven Latin American countries over the 22-year period. The regression model as a whole was found to be statistically significant and returned an r-squared value of about 0.75, indicating that the model predicts the dependent variable well.

**Table 2: Regression Results for Econometric Model**

Dependent Variable: Human Development Index Value	
Ln (GDP Per Capita)	0.2215** (0.0916)
Ln (Education Expenditure)	0.0221** (0.0102)
Ln (Health Expenditure)	0.0526*** (0.0115)
Ln (GNI Per Capita)	-0.2191** (0.0917)
Unemployment	-0.0015* (0.0009)
Infant Mortality	-0.0062*** (0.0004)
Inflation	-0.0006 (0.0007)
Constant	-0.3481*** (0.0240)

Prob > F	0.0000
R-Squared	0.7542
Adjusted R-Squared	0.7469

Note: \*\*\*, \*\*, and \* denotes significance at the 1%, 5%, and 10% respectively. Standard errors in parentheses.

The GDP variable was found to be positively correlated with HDI value and statistically significant at the 5% level. This finding was expected as generally, increased GDP per capita ties into greater standard of living and financial security. The EDU variable was also found to have a positive correlation with HDI and statistically significant at 5%. Again, this result was expected as education as a dimension is one of the three main pillars of the HDI calculation. Similarly, the HEA variable had a positive correlation as was significant at the 1% level. Health is another dimension of the HDI calculation, so this result was expected. One interesting finding was the negative correlation between the GNI variable and HDI. Since a decent standard of living is the third dimension of HDI, a positive correlation was expected. However, the significant correlation between the GDP and GNI variables could explain this unexpected result. The UNEMP variable was negatively correlated with HDI and statistically significant at 10%. This result makes sense as higher unemployment is usually correlated with a loss of income and job security, which would negatively impact standard of living and human development. Furthermore, the INF MORT variable was also found to have a negative relationship with HDI and statistically significant at the 1% level. Again, this was expected given that a higher infant mortality typically indicates worse public health and lower human development. Finally, the INFLAT variable was found to be negatively correlated with HDI but not statistically significant. This result makes sense given that low levels of

inflation are typically considered sustainable and linked to economic growth. It is likely, however, that much higher rates of inflation could potentially negatively impact human development.

## **5.0 CONCLUSION**

In summary, the Human Development Index is a reliable measure of human development and standard of living. The results indicate that the HDI measure does indeed reflect alternative measures of standard of living and overall well-being, outside of the measures that are used in its calculation. For example, this study found that HDI was negatively correlated with both unemployment and infant mortality. Although these measures are not directly used in the calculation of the HDI value, this would indicate that the HDI measure reflects changes in alternative measures of standard of living. Based on this study, the HDI value is a fairly precise and accurate measure of a given country's standard of living and human development.

This study has several implications for policy makers seeking to improve economic and human development within these Latin American countries. First, greater government expenditure on healthcare and education is positively associated with a greater HDI value. In other words, greater investment in these areas can work to improve human development. Furthermore, devoting investment and research into specifically reducing infant mortality can help to improve human development. Additionally, the results of this study also indicate that economic policy makers should aim to reduce unemployment in order to increase quality of life for citizens.

However, there are several limitations to the findings of this study. First, the data set only incorporated data from eleven Latin American countries. Future research could

focus on different areas of the world to test this study's results across different geographical regions. Secondly, all of the included countries were either upper- or middle-income countries. It is possible that testing the correlation between HDI and alternative standard of living measures within lower-income countries could yield different results. Furthermore, the data set only incorporated 22 years of recent data, from 2001-2022. Using a longer or more recent data set could potentially uncover different patterns and trends in the realm of human development. Finally, the econometric model was run using only a handful of alternative standard of living measures. Future research could explore the relationship between HDI and additional human development measures, such as access to the internet, access to clean water, etc. These studies could work to further evaluate and understand the accuracy and precision of HDI as a quality of life and human development measures.

### **Appendix A: Variables and Expected Signs**

<b>Acronym</b>	<b>Variable Description</b>	<b>What it captures</b>	<b>Expected sign</b>
GDP	GDP per capita.	The country's total production per person.	+
EDU	Education expenditure as a percentage of GDP.	The country's investment into sustaining and improving its education system.	+
HEA	General health expenditure as a percentage of GDP.	The country's investment into sustaining and improving its healthcare system.	+
GNI	GNI per capita.	The country's total national income per person.	+
UNEMP	The number of people unemployed as a	The country's level of financial security for its citizens.	-

	percentage of the total labor force.		
INF MORT	The total number of infant deaths per 1,000 live births.	The country's general level of public health and medical care.	—
INFLAT	The percentage change in the overall price level of consumer goods.	The country's overall level of price stability.	—

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