Articles

Manipulation of statistics in information: a worrying practice

Manipulación de la estadística en la información: una práctica preocupante

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ABSTRACT

Statistics is a very versatile and indispensable tool for analyzing and making decisions in a wide range of areas, such as science, politics and communication. However, it can be manipulated for questionable purposes and generate serious consequences in society as a result of its use. The manipulation of statistics in information produces a distortion of the truth, affecting people's decision-making, individually and in groups, producing: making erroneous decisions, based on false information; economic losses due to investments or purchases based on unfounded information; and, health risks, caused by the lack of important information on safety or effectiveness. To illustrate the case, a methodology based on critical analysis was applied; evaluating and contrasting sources, identifying biases and inconsistencies and selecting validated information, conducting a context search, examining the environment and the variables that influence the statistics and the techniques used to display the data at the convenience of the interested parties. Finally, the ethical and social implications of this manipulation were discussed, as well as possible solutions to prevent and combat it.

Keywords: Manipulation, distortion, consequences, critical analysis, public perception, ethics.

RESUMEN

La estadística es una herramienta muy versátil e indispensable para analizar y tomar decisiones en una amplia gama de ámbitos, como la ciencia, la política y la comunicación. Sin embargo, puede ser objeto de manipulación con fines cuestionables y generar graves

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consecuencias en la sociedad, como producto de su uso. La manipulación de la estadística en la información produce una distorsión de la verdad, afectando la toma de decisiones de las personas, de manera individual y grupal, produciendo: toma de decisiones erróneas, basadas en información falsa; pérdidas económicas por inversiones o compras en base de información infundada; y, riesgos para la salud, provocados por la falta de información importante sobre seguridad o eficacia. Para ilustrar el caso, se aplicó una metodología en base al análisis crítico; evaluando y contrastando las fuentes, identificando sesgos e inconsistencias y seleccionando información validada, realizando una búsqueda de contexto, examinando el entorno y las variables que influyen en las estadísticas y las técnicas utilizadas para mostrar los datos a conveniencia de los interesados. Finalmente, se discutieron las implicaciones éticas y sociales de esta manipulación, así como posibles soluciones para prevenirla y combatirla.
Palabras clave: Manipulación, distorsión, consecuencias, análisis crítico, percepción

INTRODUCTION

Statistics is a tool that allows organizing, analyzing and interpreting data, becoming a fundamental discipline to be used in a wide range of fields, which could start with science, administration, government management, politics, media, etc.

The article analyzes the impact of statistical manipulation on public perception and explores the techniques used to distort statistical data. Manipulation of statistical information is a serious problem that threatens trust in information, informed decision making, and social welfare. It is crucial to investigate this issue to better understand its mechanisms, consequences and possible solutions.

- This practice can be carried out in a variety of ways, such as, for example:
  - Selecting the data to be presented. One can choose to present only data that support the position one wishes to defend, leaving aside data that do not (Kuhn, Anahid, & Modrek, 2021).
  - Modify the data. One can alter the data, so that they appear more favorable to the position one wishes to defend.
  .
  - Present the data in a misleading way. Graphs, tables or indicators may be used that distort the meaning of the data.

Consequently, what we want to emphasize is the importance of transparency, honesty, individual and collective responsibility in the presentation of statistical data, to ensure that a well-informed society is able to make decisions based on evidence.

MATERIALS AND METHODS

For the realization of this article we used as specific inputs, information provided by relevant scientific articles that identify how statistical manipulation is produced and applied; and statistical information on the sectorization of the employed population (15 years and older) between Sep. 20 - Nov. 23 in Ecuador, obtained from the INEN web pages.

Qualitative method: The application of this method was used to obtain the criteria, opinions of the scientific articles and others, from the web pages that support the structural sequence of the content of this article that refers to statistical manipulation.

Quantitative - descriptive method: The use of this method was used to show an applied example of how statistical data can be shown and interpreted, according to the applied procedure.
First, the motivations behind the manipulation of statistics, which may include political, commercial or ideological interests, etc., are examined.

Then, concrete examples of how this manipulation is carried out in different fields, such as economic reports, scientific studies and opinion polls, are given. Techniques such as cherry picking, misleading presentation of graphs and omission of relevant information are explored.

In addition, the consequences of the manipulation of statistics on public perception are analyzed. This practice can generate confusion and misinformation, making it difficult for citizens to make informed decisions. The ethical and social implications of this manipulation are also discussed, including the damage to public trust and the erosion of the credibility of information sources.

And an application is described, to show how statistical information can be displayed with the use of various procedures, to obtain certain results that are not visualized in the way they are reported to the public.
The manipulation of statistics is an increasingly common practice in the media. The media can use the manipulation of statistics to attract the attention of readers or viewers, or to promote a certain agenda.

Some examples of manipulation of statistics in the media are:
- Presenting data without context. Data may appear more relevant or impactful if

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presented without context . For example, it may be said that the number of crimes has increased by 20%, but if the time period in which this increase occurred is not specified, the data can be misleading.

- Using misleading graphs or tables. Graphs or tables can be used to distort the meaning of the data. For example, a graph with an exaggerated scale can be used to make a change appear more important than it really is.

- Using misleading language. The language used to present data can be misleading. For example, the word reduction may be used to refer to a 1% decrease, when in fact it is a very small change.

The manipulation of statistics can have negative ethical and social implications, because it can be used to mislead people and manipulate them into taking a certain position or making a certain decision.

Ethical implications

Manipulation of statistics can violate the following ethical principles:
- Truthfulness. Information must be truthful and accurate. Manipulation of statistics can distort reality and create a false picture of the situation.

- Transparency. People have the right to know the information in a transparent and complete way. Manipulation of statistics can hide information or present it in a misleading way (Banco Central Del Ecuador, n.d.).

- Fairness. Information should be presented in a fair and equitable manner (Economic Commission for Latin America and the Caribbean, n.d.). Manipulation of statistics can be used to discriminate against or disadvantage certain groups of people.

RESULTS

The manipulation of statistics can have the following negative social consequences:
- Influence on public decisions. The manipulation of statistics can be used to influence public decisions, such as government policies or laws (Aragão & Linsi, 2020). Being able to have a negative impact on society, by making decisions based on misleading information.
- Disinformation. The manipulation of statistics can be used to disseminate disinformation, which is false or misleading information, with the purpose of misleading people. Disinformation can have a negative impact on society, generating distrust in institutions and making it difficult to make informed decisions.
- Manipulation of public opinion. Manipulation of statistics can be used to manipulate public opinion on controversial issues. This has a negative impact on society, dividing it and making dialogue and consensus difficult.

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Consequences of statistical manipulation
The manipulation of statistics can have serious consequences for society. For example, it can be used to:

- Influence public decisions. Politicians can use the manipulation of statistics to justify their policies or to attack their opponents .

- Promote products or services. Companies can use the manipulation of statistics to sell their products or services.

- To induce public opinion. The media can use manipulation of statistics to influence public opinion on controversial issues (Anna, Kalinina, & Yusupova, 2019).

How to identify the manipulation of statistics.
It is important for citizens to be aware of statistical manipulation and be trained to identify it. To do so, the following aspects should be considered:

- Be critical of the information you receive. Do not get carried away by flashy headlines or data that seem to confirm certain beliefs.

- Ask about the context: In what time period was the data collected? What factors may have influenced the data?

- Analyze graphs and tables. What information are they showing? How are they presented?

- Be suspicious of misleading language. What does the language actually mean?

As a second aspect, statistical information provided on the INEC web page is used to show an example of how statistical information can be manipulated by applying different techniques that are valid from any point of view, but that show different ways of looking at quantitative information and that can lend themselves to different types of interpretation.

To begin to develop what has been indicated, some aspects of the procedure followed are mentioned:

1. The statistical information below corresponds to a file 202311_Tabulados_Mercado_Laboral_EXCEL.xlsx found in the section Tabulations and historical series (Excel button) of INEN's web page; within this file, the information chosen for manipulation is in the Excel sheet named: 4.

The information of 4. Sectorization of Employment, consists of percentages of the Sectorization of the Employed Population (15 years and older) at the national level, urban and rural sectors, month by month from June 2007 to November 2023 (Figure 1).

2. As a first form of manipulation of the statistical information, it was chosen solely for the purpose of showing how the information can be manipulated (Figure 2), to alter the perception of the population, with the information of the formal and informal employment sectors, from September 2000 to November 2023, with two-month intervals.

Figure 1 Percentages of the sectorization of the employed population (15 years and older) in Ecuador.

Sectorización de la Población con Empleo (15 años y más)

Característica		jun-07	sep-07	dic-07	mar-08	jun-08	sep-08	dic-08	mar-09	jun-09	sep-09	dic-09	mar-10	jun-10	sep-10	dic-10	mar-11	jun-11
Nacional	Sector Formal	-	-	41,0%	-	42,5%	-	43,9%	-	-	-	43,7%	-	44,9%	-	47,2%	-	46,3%
	Sector Informal	-	-	45,1%	-	45,4%	-	43,5%	-	-	-	43,8%	-	42,3%	-	42,8%	-	42,2%
	Empleo Doméstico	-	-	3,3%	-	3,3%	-	3,5%	-	-	-	3,4%	-	3,4%	-	2,9%	-	3,0%
	No Clasificados por Sector	-	-	10,6%	-	8,8%	-	9,2%	-	-	-	9,1%	-	9,3%	-	7,1%	-	8,4%
Urbano	Sector Formal	54,7%	55,7%	54,1%	54,4%	55,8%	56,0%	56,2%	57,4%	57,7%	59,4%	57,3%	57,5%	58,6%	59,4%	60,8%	59,9%	60,5%
	Sector Informal	36,9%	36,1%	34,0%	36,6%	34,0%	35,0%	33,2%	34,0%	32,8%	31,6%	32,6%	33,0%	30,9%	33,0%	31,2%	32,0%	30,7%
	Empleo Doméstico	4,0%	4,1%	4,3%	3,9%	4,0%	3,9%	4,2%	3,7%	4,0%	3,8%	4,1%	4,1%	4,2%	3,5%	3,4%	3,9%	3,8%
	No Clasificados por Sector	4,4%	4,1%	7,7%	5,1%	6,2%	5,1%	6,4%	4,8%	5,5%	5,1%	6,0%	5,4%	6,2%	4,1%	4,6%	4,2%	5,0%
Rural	Sector Formal	-	-	15,5%	-	16,2%	-	19,1%	-	-	-	17,2%	-	18,4%	-	20,5%	-	18,9%
	Sector Informal	-	-	66,7%	-	68,1%	-	64,2%	-	-	-	65,6%	-	64,5%	-	65,7%	-	64,4%
	Empleo Doméstico	-	-	1,5%	-	1,8%	-	1,9%	-	-	-	2,0%	-	1,9%	-	1,8%	-	1,5%
	No Clasificados por Sector	-	-	16,3%	-	13,9%	-	14,8%	-	-	-	15,2%	-	15,2%	-	11,9%	-	15,1%

Fuente: Encuesta de Empleo, Desempleo y Subempleo - ENEMDU

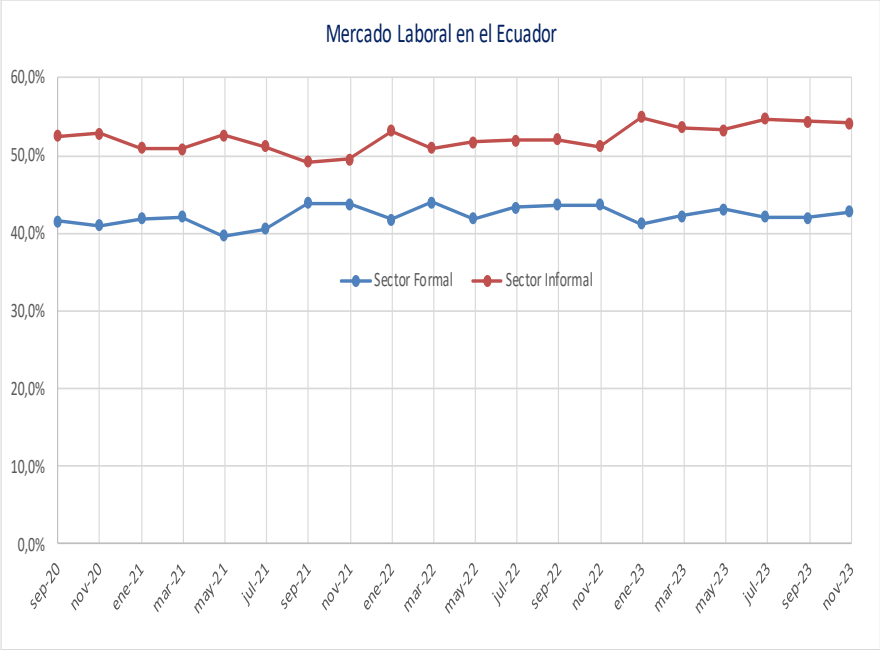
*Desde 2020 hasta mayo de 2021 se implementó en la ENEMDU cambios metodológicos asociados al tamaño y distribución de la muestra, nivel de representatividad de los estimadores y construcción de factores de ponderación, afectando la comparabilidad histórica de las estadísticas oficiales. Ante esta problemática, se decidió mantener el esquema tradicional de diseño muestral, estandarizando el cálculo de factores de ponderación a nivel de la Unidad Primaria de Muestreo y recalculando los indicadores desde septiembre 2020 hasta mayo 2021, con el fin de mantener la comparabilidad de las cifras. Para mayor información referirse a la nota técnica disponible en: https://bit.ly/3hQMHRE

Empresa: Cualquier unidad encargada de la producción de bienes y servicios para la venta o trueque.
Población con empleo en el sector formal: Personas con empleo que trabajan en empresas que tienen Registro Único de Contribuyentes.
Población con empleo en el sector informal: Personas con empleo que trabajan en empresas que **no** tienen Registro Único de Contribuyentes.
Población con empleo doméstico: Personas con empleo y que en su categoría de ocupación sea empleado doméstico.
Población con empleo no clasificadas por Sector: Personas con empleo que trabajan en empresas que no saben o no responden si su empresa tiene Registro Único de Contribuyentes.

(*)Para efectos del cálculo en la Encuesta Nacional de Empleo, Desempleo y Subempleo, las personas que trabajan en establecimientos de 100 trabajadores y más son parte del sector formal pues se considera que estos establecimientos tienes todos los registros de ley (incluyendo el RUC).

Figure 2. Labor market in Ecuador between Sep-20 to Nov-23. Source: Information taken from

Periodo	Sector Formal	Sector Informal
sep-20	41,6%	52,5%
nov-20	41,0%	52,8%
ene-21	41,9%	51,0%
mar-21	42,1%	50,9%
may-21	39,7%	52,7%
jul-21	40,6%	51,2%
sep-21	43,9%	49,2%
nov-21	43,8%	49,5%
ene-22	41,8%	53,1%
mar-22	43,9%	51,0%
may-22	41,9%	51,7%
jul-22	43,3%	51,9%
sep-22	43,7%	52,1%
nov-22	43,7%	51,2%
ene-23	41,3%	55,0%
mar-23	42,2%	53,7%
may-23	43,2%	53,3%
jul-23	42,1%	54,8%
sep-23	42,0%	54,4%
nov-23	42,7%	54,2%



Interpretation:

Formal sector: Considering as a base 40% for all periods, it is visualized that in the corresponding months of 2020 until the year 2021, during the COVID pandemic, the labor market in Ecuador has fluctuated by about 42%; from the month of July 2021 until November 2023, it has had a slight increase of approximately between 1 - 2%, with small decreases in the months of January, May 2022 and January 2023; considering all these elements, it could be stated that the formal labor market in Ecuador, has almost been a constant.

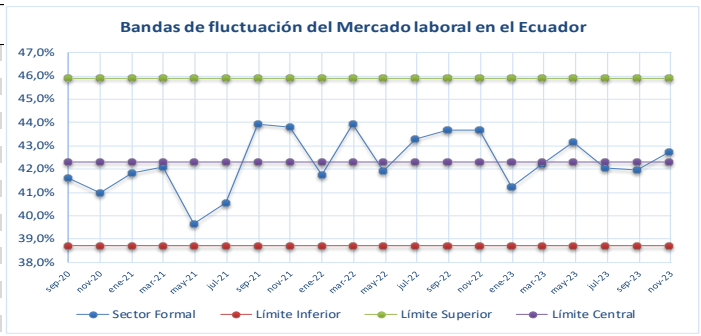
Informal sector: In a very similar manner to that indicated for the formal sector, we consider 50% as the basis for analysis, with slight increases between 1 - 3% in the same months indicated in the formal sector. This labor market could also be considered almost constant, but it should be taken into account that it is not the ideal way to prioritize the population's livelihood.

By showing the information in this way, using the two market type variables, the scale on which the results are shown allows me to disguise or smooth the variation suffered by the labor market in Ecuador. Obviously, for this type of effect to occur, it depends on the structuring of the state processes and its policies, financial management, the controls that should be applied, etc.

3. As a second way of manipulating the statistical information, two other more explicit ways of showing the statistical results are shown through graphs (Figure 3), which give an understanding of aspects that go beyond what is seen in (Figure 2), in relation to the formal sector of the labor market in Ecuador.

Figure 3. Graphs of the fluctuation bands of the formal labor market in Ecuador between Sep -20 to Nov -23.

Periodo	Sector Formal	Límite Inferior	Límite Superior	Límite Central	% Variación
sep-20	41,6%	38,7%	45,9%	42,31%	0
nov-20	41,0%	38,7%	45,9%	42,31%	-1,5%
ene-21	41,9%	38,7%	45,9%	42,31%	2,1%
mar-21	42,1%	38,7%	45,9%	42,31%	0,6%
may-21	39,7%	38,7%	45,9%	42,31%	-5,7%
jul-21	40,6%	38,7%	45,9%	42,31%	2,2%
sep-21	43,9%	38,7%	45,9%	42,31%	8,3%
nov-21	43,8%	38,7%	45,9%	42,31%	-0,3%
ene-22	41,8%	38,7%	45,9%	42,31%	-4,6%
mar-22	43,9%	38,7%	45,9%	42,31%	5,2%
may-22	41,9%	38,7%	45,9%	42,31%	-4,6%
jul-22	43,3%	38,7%	45,9%	42,31%	3,3%
sep-22	43,7%	38,7%	45,9%	42,31%	0,8%
nov-22	43,7%	38,7%	45,9%	42,31%	0,1%
ene-23	41,3%	38,7%	45,9%	42,31%	-5,6%
mar-23	42,2%	38,7%	45,9%	42,31%	2,4%
may-23	43,2%	38,7%	45,9%	42,31%	2,2%
jul-23	42,1%	38,7%	45,9%	42,31%	-2,6%
sep-23	42,0%	38,7%	45,9%	42,31%	-0,2%
nov-23	42,7%	38,7%	45,9%	42,31%	1,8%
				Promedio	0,2%



Estadísticos descriptivos

Sector	Media	Desv. Desviaci	Varianza
Formal	42,31%	1,20%	1,43
Informal	52,31%	1,64%	2,68
N = 20			

Cálculo de bandas	
Límite de control superior:	LCS=Promedio + 3*Desviación
Límite central:	LCS=Promedio
Límite de control inferior:	LCI=Promedio - 3*Desviación

$$\%\,Variación = \frac{(b-a)}{a} * 100\%$$

In order to determine the control bands, the formulas for the deviation graph were used

Límite de control superior:	LCS = Promedio + 3*Desviación
Límite central:	LCS = Promedio
Límite de control inferior:	LCI = Promedio - 3*Desviación

In (Figure 3), two graphs are shown with two totally different statistical procedures, but showing the real growth or decrease of the labor market in Ecuador, but on an average basis for both cases. While in (Figure 1), the graph shows a constant appearance, in these graphs it can be seen that in only 7 or 8 months of the 20 months taken for analysis, these are the months in which there has really been a low growth between 1 - 2% of the labor market.

Therefore, the way in which the results are presented does influence the appreciation that can be given to the information and consequently, depending on personal, group

and institutional interests, the information can be manipulated according to the purposes pursued by each one.

4. An additional example could be the misinformation of statistical data that occurred during the COVID pandemic in Ecuador, a situation that occurred at the international level, when the media reported the number of deaths, while the official media denied and reported much lower numbers than what was actually reflected in the news. One can also mention the rise of the internet, which has led to an increase in disinformation, as fake news can spread quickly and easily. This has led to a loss of trust in traditional media and has led to some people choosing to avoid news consumption altogether.

Factors that have contributed to the rise of misinformation include the emergence of citizen journalists, the growing influence of commercial and ideological interests, and the loss of credibility of traditional media.

Fake news has become an industry of its own, with people paid to write sensational stories and misleading headlines. Social networks contribute to its rapid spread.

The people most vulnerable to fake news are those with the least access to verified information, such as people in developing countries and teenagers and young adults.

DISCUSSION

The manipulation of statistics in information is a worrying practice that undermines confidence in data and institutions. It is essential to be aware of this problem and to promote transparency and honesty in the presentation of statistical data. Only in this way will we be able to guarantee an informed society capable of making evidence-based decisions.

Finally, possible solutions are proposed to prevent and combat the manipulation of statistical information. One of the proposed solutions is to promote statistical literacy among the population, so that people can understand and critically evaluate the information that reaches them. It also highlights the need to promote transparency in the presentation of data, so that they are shown in a clear and accessible manner, without distortions or manipulations. In addition, it is proposed to strengthen the mechanisms for verification and evaluation of information, in order to be able to detect and refute statistical manipulations.

Finally, the importance of individual and collective responsibility in the consumption of information is emphasized. Each individual must be aware of the possibility of manipulation and must take responsibility for verifying and contrasting the information he or she receives. Similarly, society as a whole must demand transparency and honesty in the presentation of statistical data, in order to be able to trust the information and make informed decisions.

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