

MEASURING ECUADOR'S ECONOMIC AND POLITICAL UNCERTAINTY INDEX USING GOOGLE TRENDS

*Kamila Aguirre¹, Emanuel Yaselga², Fabián Villareal³ y
Diego Tapia⁴*

Banco Central del Ecuador
Quito, Ecuador

Article Info

Received:

31st August 2023

Accepted:

5th June 2024

Keywords:

Uncertainty
Economics
Politics
Google Trends
Principal component
analysis

JEL:

C40, D80, E66

DOI:

<https://doi.org/10.47550/RCE/34.1.3>

Abstract

The measurement of uncertainty in a context of constant change is of paramount importance for informed decision-making, given its significant impact on investment, consumption, credit, and the financial stability of countries. This study employs Google Trends data and advanced statistical techniques to develop a political and economic uncertainty index for Ecuador, covering the period from 2004 to 2023. The proposed index effectively captures key moments of substantial instability in the country, including the overthrow of former President Lucio Gutiérrez, the declaration of default on external debt, the 30-S political crisis, the April 2016 earthquake, national strikes, and the COVID-19 pandemic. Furthermore, the index is correlated with other uncertainty measures, including the Emerging Markets Bond Index (EMBI), the Volatility Index (VIX), and oil prices. This index offers a real-time perspective on the evolution of uncertainty in Ecuador, which may prove valuable in anticipating the evolution of relevant macroeconomic variables such as consumption and investment.

¹ORCID: 0000-0001-9200-0427. CRediT: Research, Methodology, Software, Writing - Original Draft, Writing - Proofreading and Editing, Visualization

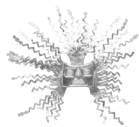
²ORCID: 0009-0003-4239-7499. CRediT: Research, Methodology, Software, Writing - Original Draft, Writing - Conceptualization, Visualization

³ORCID: 0000-0001-5056-7169. CRediT: Research, Methodology, Software, Writing - Original Draft, Conceptualization, Visualization

⁴ORCID: 0000-0002-9551-5028. CRediT: Conceptualization, Methodology, Supervision

E-mail: kaguirre@bce.ec; eyaselga@bce.ec; villal32@msu.edu; dtapia@bce.ec

Copyright © 2024 Aguirre, Yaselga, Villareal and Tapia. Authors retain the copyright of this article. This article is published under the terms of the Creative Commons Attribution Licence 4.0. (*) The views expressed in this paper are exclusively those of the authors and do not necessarily reflect the position of the Central Bank of Ecuador or its Board members.



MEDICIÓN DEL ÍNDICE DE INCERTIDUMBRE ECONÓMICA Y POLÍTICA DE ECUADOR MEDIANTE GOOGLE TRENDS

*Kamila Aguirre¹, Emanuel Yaselga², Fabián Villareal³ and
Diego Tapia⁴*

Banco Central del Ecuador
Quito, Ecuador

Información

Recibido:

31 de agosto de 2023

Aceptado:

5 de junio de 2024

Palabras clave:

Incertidumbre
Economía
Política
Google Trends
Análisis de componentes
principales

JEL:

C40, D80, E66

DOI:

<https://doi.org/10.47550/RCE/34.1.3>

Resumen

La medición de la incertidumbre en un contexto de cambio constante es de suma importancia para la toma de decisiones informadas, dada su significativa influencia en la inversión, el consumo, el crédito y la estabilidad financiera de los países. Este estudio utiliza datos de Google Trends y técnicas estadísticas avanzadas para desarrollar un índice de incertidumbre política y económica para Ecuador, cubriendo el período desde 2004 hasta 2023. El índice propuesto captura de manera efectiva momentos clave de inestabilidad en el país, incluyendo el derrocamiento del expresidente Lucio Gutiérrez, la declaración de default de la deuda externa, la crisis política del 30-S, el terremoto de abril de 2016, las protestas sociales y la pandemia de COVID-19. Además, el índice demuestra una correlación con otras medidas de incertidumbre, incluyendo el Emerging Markets Bond Index (EMBI), el Índice de Volatilidad (VIX) y los precios del petróleo. Este índice ofrece una perspectiva en tiempo real sobre la evolución de la incertidumbre en Ecuador, lo cual puede ser valioso para anticipar la evolución de variables macroeconómicas relevantes como el consumo y la inversión.

¹ORCID: 0000-0001-9200-0427. CRediT: Investigación, Metodología, Software, Redacción - Borrador original, Redacción - Corrección y edición, Visualización

²ORCID: 0009-0003-4239-7499. CRediT: Investigación, Metodología, Software, Redacción - Borrador original, Redacción - Conceptualización, Visualización

³ORCID: 0000-0001-5056-7169. CRediT: Investigación, Metodología, Software, Redacción - Borrador original, Conceptualización, Visualización

⁴ORCID: 0000-0002-9551-5028. CRediT: Conceptualización, Metodología, Supervisión

Correo electrónico: kaguirre@bce.ec; eyaselga@bce.ec; villa132@msu.edu; dtapia@bce

Copyright © 2024 Aguirre, Yaselga, Villareal y Tapia. Los autores conservan los derechos de autor del artículo. El artículo se distribuye bajo la licencia Creative Commons Attribution 4.0 License. Las opiniones expresadas en este documento son exclusivamente las de los autores y no reflejan necesariamente la posición del Banco Central del Ecuador o de los miembros de su Directorio.

1. INTRODUCTION

In an ever-changing economic environment, understanding and quantifying uncertainty has become crucial for decision-makers in a country's economy. Theories and empirical evidence demonstrate that economic uncertainty has a significant impact on the level of investment and consumption (Bernanke, 1983; Fischer, 1993; Pindyck, 1990). Consequently, an accurate and timely measurement is important for countries.

In an increasingly interconnected world, it is essential to take advantage of digital tools to obtain measurements of variables of interest that were previously difficult to get. In recent years, the rapid development of technology and the growing availability of online data have opened new possibilities for analyzing and forecasting economic uncertainty. This study highlights the potential use of Google Trends data to measure political and economic uncertainty in Ecuador. Google Trends data tracks and quantifies searches on the world's most widely used search engine¹. Previous studies have shown that Google search trends can be indicative of economic activity and of the perceptions and views of economic agents (Choi and Varian, 2012).

The primary objective of this research is to construct an index to measure political and economic uncertainty in Ecuador based on the use of Google Trends data. To this end, we analyze the behavior of searches from 2004 to 2023 for terms such as unemployment, inflation, economic crisis, among others. These searches provide a unique window into citizens' perceptions of the country's economic situation, as well as their expectations for the future.

The application of statistical techniques enabled us to ascertain notable shifts in the evolution of economic and political uncertainty in Ecuador. To the best of our knowledge, our research represents the first attempt to utilize Google Trends data in constructing an uncertainty index in Ecuador. This information is relevant considering the numerous political and economic instability events that have characterized the country. These include social strikes, the health crisis due to the pandemic, the fall of governments, internal political disputes, high levels of indebtedness and persistent fiscal deficit, dependence on oil prices, and the evolution of social welfare indicators (adequate employment, poverty and inequality).

The results of this study are expected to provide a more accurate and real-time view of uncertainty in the country, which can be of great value to economic policymakers, investors, and other stakeholders. In addition, this study can lay the foundation for future research in the field of online data-driven economics and the measurement of economic uncertainty in other countries with similar contexts.

¹ According to GlobalStats, in 2023, Google held a market share of 92,38 % in the global search engine market.

The structure of the study is as follows. Following the introduction, a literature review on theoretical and empirical studies on the relationship between uncertainty, economic activity, and the different methodologies used for its measurement is presented, along with an analysis of the use of Google Trends data in other countries and contexts. Section Three outlines the information and methodology employed to construct the Economic and Political Uncertainty Index for Ecuador. Section Four presents the results, while Section Five concludes.

2. LITERATURE REVIEW

Fischer (1993) posits that while macroeconomic stability is not a sufficient condition for maintaining sustainable growth, it is, nevertheless, necessary. The author identifies two potential channels through which uncertainty may affect economic growth. Firstly, uncertainty impairs the efficacy of the price mechanism proposed by Lucas (1973) by reducing productivity. Conversely, uncertainty affects the level of investment in countries. This final channel has been analyzed by Pindyck (1990), who suggests that these effects are explained by the irreversible nature of investment. There is no disinvestment, so the committed resources become sunk costs if they are not used. Consequently, decisions can be delayed until new information provides greater certainty to investors.

Bernanke (1983) argues that when agents' investment projects are irreversible, the trade-off between the incremental gains from making the commitment early and the incremental gains from waiting for more information must be evaluated. He demonstrates that following an uncertainty shock, the value of waiting for more information increases, prompting firms to reconsider their investment plans and resulting in a significant decline in investment levels.

As stated by Baker et al. (2016), the certainty regarding the direction of economic policy is also a fundamental factor for fostering sustainable growth. In fact, this affects the behavior of consumers, who are more likely to save, invest, and plan for the long term when faced with a stable and predictable economic future. Furthermore, an uncertain environment can also affect the level of inflation in the event of abrupt changes in the monetary and fiscal policies that governments may adopt. Finally, the authors highlight that the volatility of financial assets may be affected, which in turn has implications for the solvency of institutions, with consequences for the financial stability of the economy.

The impact of uncertainty may also vary according to country characteristics. The study by Ahir et al. (2022) examines the relationship between shocks to the World Uncertainty Index (WUI) and economic growth in 143

countries. The results indicate that this index is typically higher in developing countries and that its fluctuations result in substantial declines in economic activity. Moreover, the study revealed that the impact of uncertainty is amplified in countries with less robust institutional frameworks and greater financial constraints.

Despite the importance of quantifying uncertainty, its measurement remains a challenge (Weinberg, 2020). Baker et al. (2016) proposed the Economic Policy Uncertainty Index (EPU) for the United States and twelve other economies. This was the seminal work on which subsequent applications in other countries, such as Spain (Ghirelli et al., 2019) and Japan (Arbatli Saxegaard et al., 2022), were based.

The index is constructed by counting the number of times the words related to uncertainty, economy, and politics (e.g., Congress, deficit, Federal Reserve) are found in articles from the ten most widely circulated newspapers in the United States. The results of the study indicate that this index can serve as a reliable proxy for capturing the dynamics of economic policy uncertainty in the country (Baker et al., 2016). In addition to this construction, the authors evaluate the impact of shocks to this indicator on economic variables. Their findings show that the indicator affects stock price volatility and reduces investment and employment.

The implementation of vector autoregressive (VAR) models by Arbatli Saxegaard et al. (2022) indicates that innovations in the EPU have a detrimental impact on Japan's macroeconomic performance, evidenced by a decline in investment, employment, and output. Additionally, the authors posit the necessity of maintaining credible policies to reduce uncertainty and promote economic growth and development.

Similarly, Bachmann et al. (2013) found that there was an initial negative effect on output, which dissipated once the moment of uncertainty had passed. This effect was designated as the "wait-and-see" phenomenon and was analyzed for the United States and Germany based on business outlook surveys. The index was incorporated into a VAR model, and the results demonstrated that an increase in business uncertainty was associated with a significant reduction in output and employment in both countries. In the United States, the impact of uncertainty on economic activity was observed to be more gradual but persisted over a longer period.

For the Ecuadorian case, Avellán et al. (2022) estimate a macroeconomic uncertainty index through maximum likelihood and Bayesian methods. The index is constructed using 24 variables, which are grouped into six categories: (i) the monetary and financial sector, (ii) international trade, (iii) prices and confidence indexes, (iv) real sector indexes, (v) public finance statistics, and (vi) labor market indexes. A comparison of the evolution of the index with the Emerging Markets Bond Index (EMBI) of Ecuador revealed a similar trajectory for both indexes, with a correlation of 0,53 throughout the entire period (2004-2019). Additionally, a SVAR analysis demonstrated that uncertainty

shocks are of considerable magnitude and persistent in relevant Ecuadorian macroeconomic variables.

Based on Baker et al. (2016), Padilla (2019) constructed an index of economic policy uncertainty for Ecuador, drawing on data from a leading newspaper within the country, *El Comercio*. The index aligns with periods of heightened uncertainty in recent history. A comparison with other measures of uncertainty and possible leading indicators—including the United States EPU, Colombian EPU, oil prices, and the Volatility Index (VIX)—revealed significant correlations.

Although indices constructed from news and articles from major newspapers have been widely used in economic literature (Arbatli Saxegaard et al., 2022; Baker et al., 2016; Ghirelli et al., 2019; Shoag and Veuger, 2016), their implementation is restricted by several factors, particularly in countries where access to historical media information is limited or where there is bias in the information disseminated (Kupfer and Zorn, 2020). Consequently, researchers globally have attempted to identify alternative methodologies for capturing the inherent uncertainty associated with countries' economic policies. Among these methodologies, the use of Google Trends has emerged as a particularly noteworthy approach (Bilgin et al., 2019; Castelnuevo and Tran, 2017; Donadelli, 2015; Pratap and Priyaranjan, 2023; Weinberg, 2020).

This information is of particular importance, given that the Internet has become the primary source of information (Ørmen, 2016). For these reasons and given the vast quantity of data that these new sources can provide, the use of tools such as Google Trends has gained prominence in the economic literature (Donadelli, 2015). According to Jun et al. (2018), the use of this tool in research has increased significantly, making it possible not only to describe trends, but also to identify patterns, predict future changes, and understand the needs of society, advances in various fields, and market fluctuations.

As Choi and Varian (2012) observe, this tool furnishes daily reports on the volume of searches on various topics. This data can be correlated with the current level of economic activity and employed to describe economic conditions. In their study, they found that these query indices often correlate with various economic indicators and can be useful for predicting short-term economic trends. Accordingly, Woloszko (2020) estimates a weekly activity indicator covering 46 OECD/G20 countries. Ferrara and Simoni's study use Google searches for the nowcasting of euro area Gross Domestic Product (GDP) and analyzes whether this information can improve the accuracy of the nowcasting by controlling for official variables. The results suggest that Google data offer advantages in pseudo-real time nowcasting of quarterly GDP growth, especially during the first four weeks of the quarter when macroeconomic information is limited (Ferrara and Simoni, 2019).

Therefore, this source of information has also been used to construct economic policy uncertainty indices. For the case of Turkey, Bilgin et al. (2019) constructed this index for their country and compared it with uncertainty

indexes for other countries such as the United States. Their results from VAR models and correlation analysis show that such an index adequately captures uncertainty in the country. Similarly, Pratap and Priyaranjan (2023) estimate the macroeconomic impact of uncertainty using Google Trends. Once this index is constructed, they use an instrumental variables SVAR model, which allows them to find evidence on the effect of uncertainty on growth and inflation. Finally, they conclude that the use of the indicator constructed from Google data improves the accuracy of forecasting models compared to other measures of uncertainty.

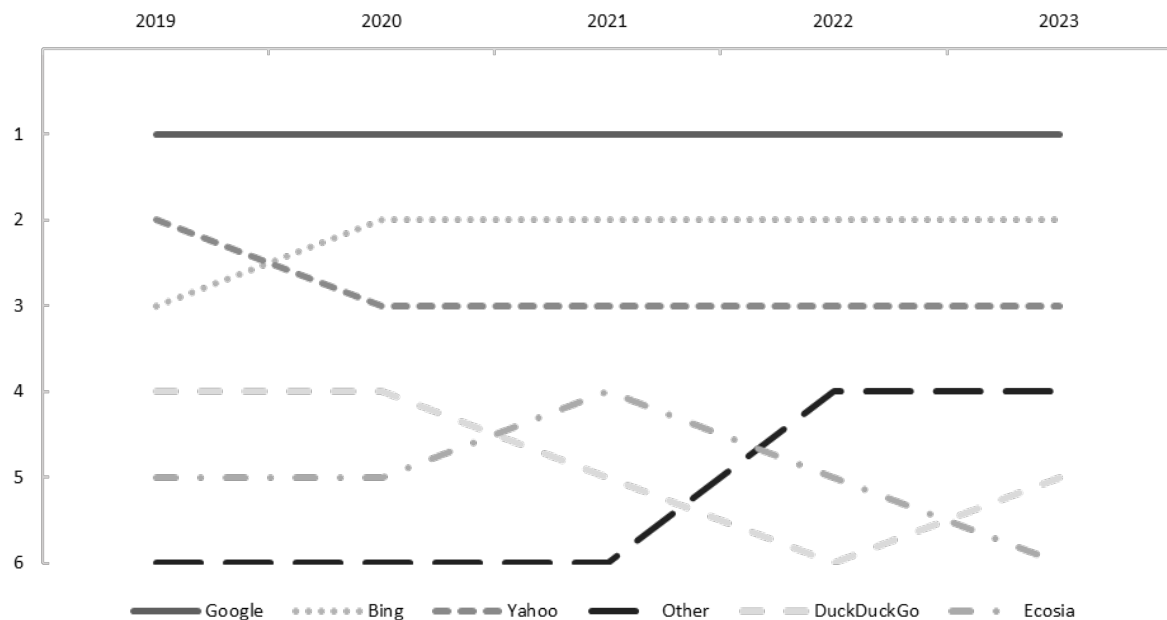
In South America, Figueroa (2014) estimates an index of Economic Policy Uncertainty for Chile and assesses its impact on the stock market. The results show that the index peaks during episodes of political uncertainty and shows the expected correlation with key variables of the Chilean business cycle, national political risk measures, and international political uncertainty indices.

3. MATERIALS AND METHODS

To construct the Economic and Political Uncertainty Index for Ecuador (EPUI, henceforth), the Google Trends tool was deemed an appropriate means of obtaining a metric that would capture trends, seasonal fluctuations, and specific events regarding the popularity or interest in topics that reflect the macroeconomic and conjunctural characteristics of the Ecuadorian economy.

As previously stated by Weinberg (2020), Google has become the most significant search engine globally. This is also evident in Ecuador, where approximately 97 % of citizens utilize it as their primary resource (Figure 1). Consequently, it can serve as a valuable source of information to assess the country's economic policy uncertainty.

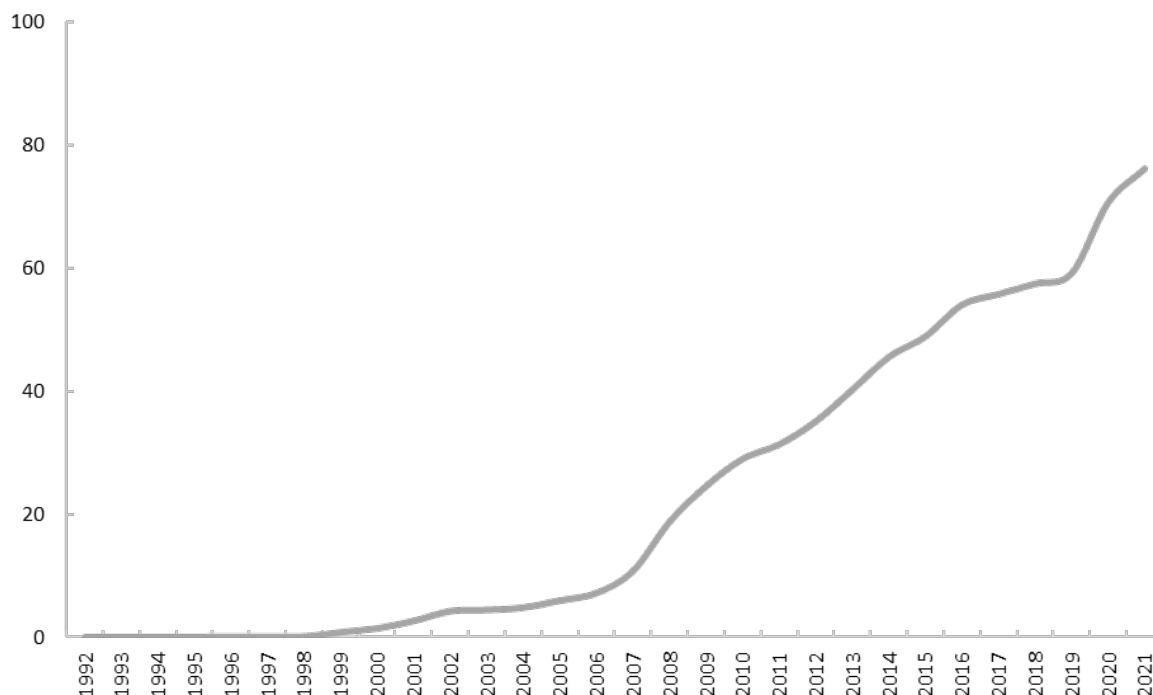
Figure 1. Search Engines Ranking in Ecuador
Ranking, 2019-2023



Source: GlobalStats - Search Engine Market Share Worldwide

This is a noteworthy observation in the context of the remarkable increase in internet penetration in Ecuador. In 1992, less than one percent of the population had access to the internet, a figure that has grown exponentially since then. According to the World Bank, by 2021, 76,2 % of Ecuadorians were Internet users (Figure 2).

Figure 2. Internet Users in Ecuador as Percentage of Total Population
Percentage, 1992-2021



Source: World Bank

Google Trends is a tool that provides information about the popularity and interest of certain topics over time, based on users' searches for keywords or phrases using the Google search engine. To generate the data, this tool employs a methodology that incorporates information from searches conducted on Google across the globe since January 2004. It is also capable of disaggregating searches by geographic location².

It is important to note that this tool does not provide information on the number of searches performed for each term over time. Instead, it offers an indicator (IGT), which represents the normalization of the number of searches to provide a metric of the relative interest of each word. The IGT is therefore a measure that reflects the proportion of searches for a given term relative to the total number of searches for a set of words in each geographic location and time.

It takes values between 0 and 100, with 100 representing the point of maximum interest in terms of searches for a given term, given a specific period

² Google Trends anonymizes searches and aggregates them to protect the privacy of users.

and set of words.³ It is crucial to acknowledge that due to the normalization procedure, the IGT value may fluctuate over time, contingent upon the set of words analyzed and the period in which they are searched.

Generally, IGT can be defined by:

$$IGT_{r,t}^p = \frac{SVT_{r,t}^p}{TSV_t \cdot \max_{q,m}(SVT_{r,q}^m / TSV_q)} \quad (1)$$

Where $IGT_{r,t}^p$ represents the Google Trends Index for word p in region r and period t . It is determined by the relative comparison of the total number of searches for word p in the defined region and time ($SVT_{r,t}^p$) in relation to the product of the total Google search volume for period t (TSV_t) and the maximum ratio among all queries q in the considered word group m , relative to the total sample of the period (TSV_q).

In accordance with the characteristics of the Ecuadorian economy and the political and social situation, the words under consideration were divided into ten categories. These reflected the various topics of interest, including, but not limited to, cities or geographical locations, elections, taxes, macro-economic factors, social strikes, the names of Ecuadorian political figures, political factors, social and security issues, and exogenous factors. Appendix 1 presents the words used in the index construction and their categorization into the themes of interest.

In accordance with the categories of words, queries were conducted on the Google Trends platform, considering the searches carried out in Ecuador since January 2004. In accordance with the limitations of the connection to Google's Application Programming Interface (API), the queries were carried out through word vectors composed of a maximum of five elements⁴. Consequently, an IGT was generated for each word comprising the search vectors of each category on each analysis date, based on the information provided by Google. Subsequently, to obtain a representative IGT for each category of interest, the results were aggregated by groups of words for each period according to the following equations:

$$IGT_{g_c,t} = \sum_{pg_c=1}^{ng_c} IGT_{pg_c,t} \quad (2)$$

³ This implies that if only a single word is analyzed, the IGT will have a value of 100 over a period, contingent on the search interest of the users. However, when a set of words is analyzed, only one of them will have an IGT of 100, representing the maximum interest in that topic relative to the other words over time.

⁴ To wit, each category or topic of interest is divided into groups of up to five words for query in the Google Trends tool.

$$IGT_{c,t} = \sum_{g_c=1}^{nc} IGT_{g_c,t} \quad (3)$$

Where g_c represents each of the nc vectors associated to the category of interest c throughout each period t . On the other hand, pg_c represents each of the words that forms the search vector g_c , where $ng_c \leq 5$, according to the group of words considered within each of the ten analyzed categories.

After estimating the representative IGT for each category, a principal component analysis (PCA) was conducted to reduce the dimensionality of the data and to generate factors that represent the collective search behavior of users regarding the topics of interest.

To estimate the EPUI index, a weighted average of the identified components was calculated. The weight of each factor was determined by the ratio between its eigenvalue and the sum of the eigenvalues of the five factors considered. This ratio was calculated using Equations 4 and 5.

$$EPUI_t = \sum_{i=1}^k w_i f_{i,t} \quad (4)$$

$$w_i = \frac{eigen_i}{\sum_{j=1}^k eigen_j} \quad (5)$$

Where w_i represents the weight assigned to each of the k factors $f_{i,t}$ over time, and $eigen_i$ represents the eigenvalue corresponding to each component. Finally, to enhance the interpretability of this index, it was normalized between 0 and 100, where 100 represents the period in which the greatest number of searches were made for the words considered, thus, reflecting higher uncertainty. The normalized EPUI is defined as follows:

$$EPUIz_t = \frac{EPUI_t - \min(EPUI_t)}{\max(EPUI_t) - \min(EPUI_t)} \quad (6)$$

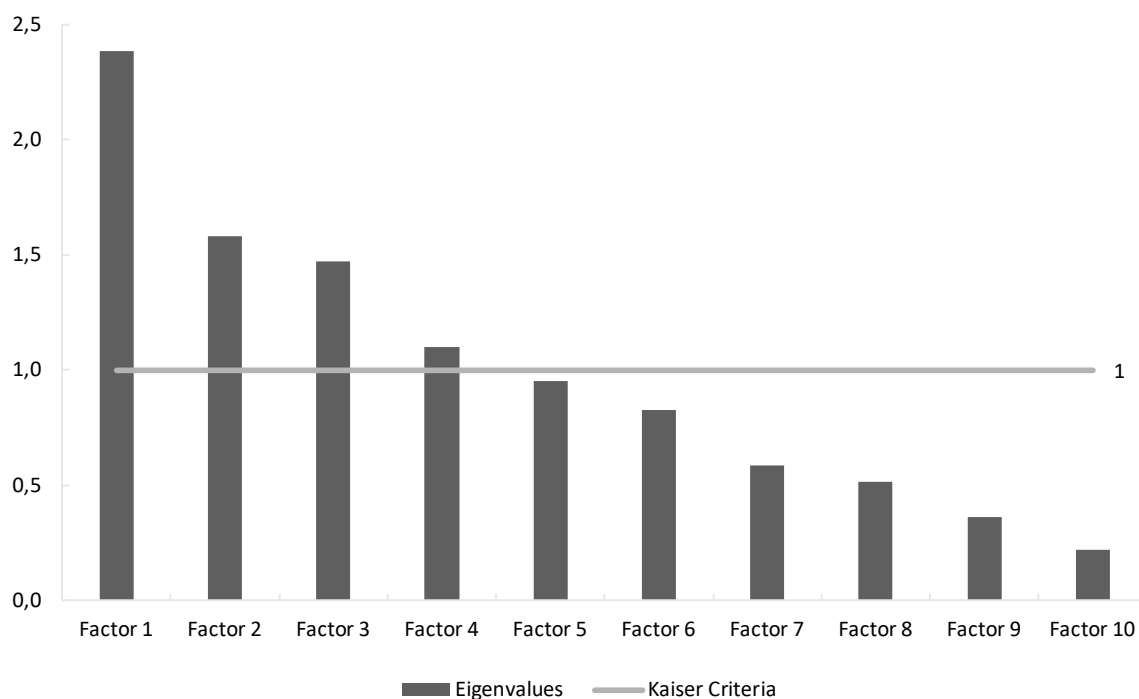
4. RESULTS

4.1. Principal Components Analysis

The selection of the factors to be considered for the construction of the index was based on multiple criteria addressed in other empirical studies. First, the Kaiser Criteria was analyzed, which establishes that components with an

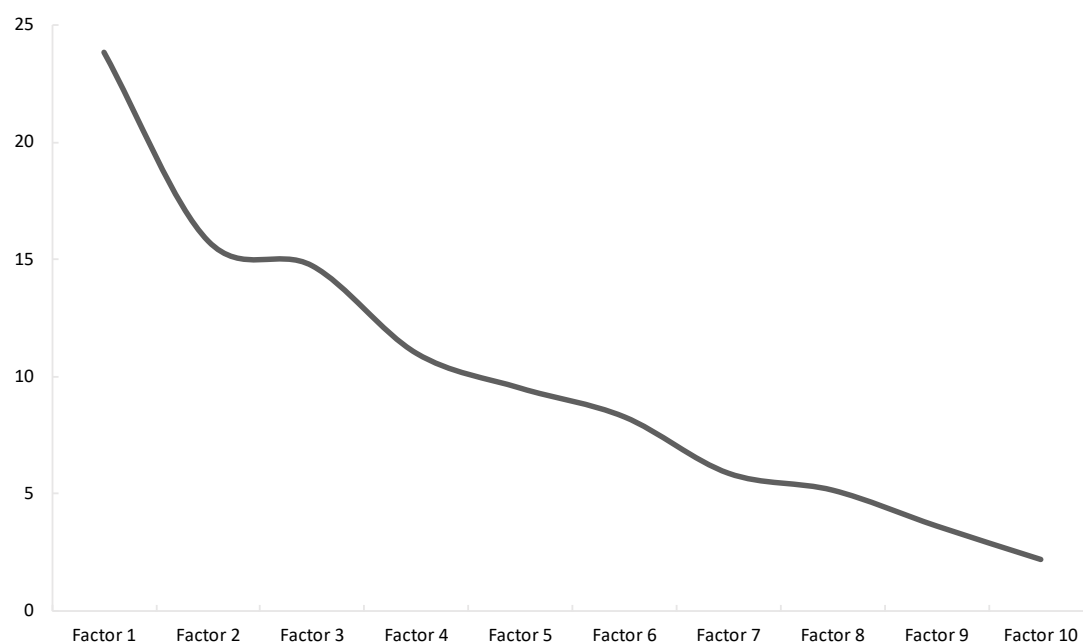
eigenvalue greater than 1 should be selected (Guttman, 1954; Kaiser, 1960). Based on this criterion, the number of factors to be considered for the construction of the index should be 4 (Figure 3).

Figure 3. Kaiser Criteria



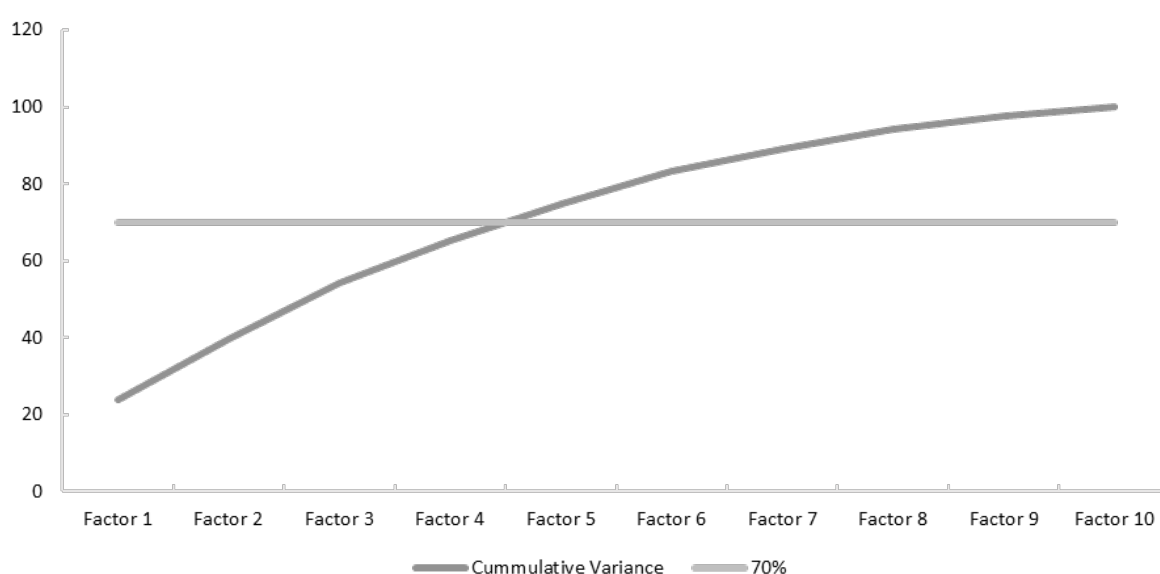
Source: Authors

Another useful tool for factor selection is the scree plot, which allows for the observation of the percentage of variance explained by each factor. The fundamental principle is that the number of factors to be selected will be identified when a breakpoint is observed in the graph (Cattell, 1966). Accordingly, the optimal number of factors to be included in the index would be between four and five (Figure 4).

Figure 4. Scree Plot

Source: Authors

Finally, the percentage of variance accumulated in each factor is analyzed in Figure 5. The results indicate that the first five factors collectively account for 74,8 % of the total variance. Given the indications from previous studies that between 70 % and 90 % of the variance should be explained (Jolliffe, 2002), it was deemed preferable to select five rather than four factors.

Figure 5. Cumulative Variance Explained

Source: Authors

The principal component analysis revealed that the words contributing most significantly to Factor 1 were those associated with politics, macroeconomics, and security. These categories were found to be central to the variance explained by this factor, indicating a strong influence on the overall uncertainty index.

In contrast, Factor 2 was dominated by words from the social factors and cities categories. This indicates that social issues and urban-related terms were pivotal elements in this dimension of uncertainty.

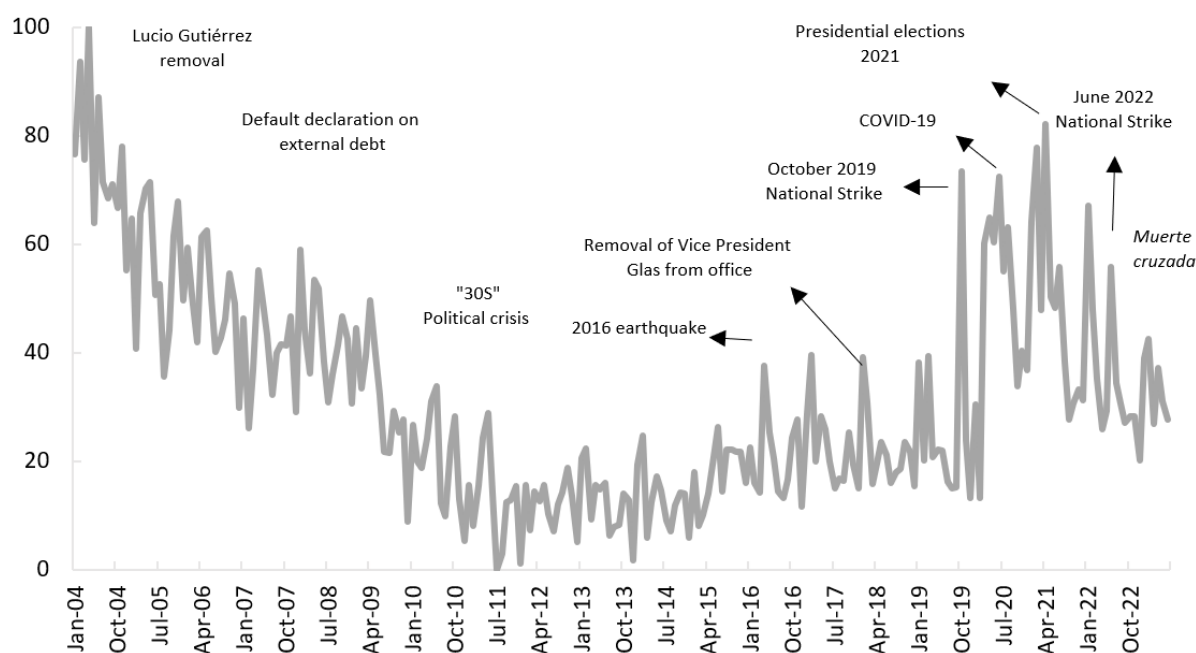
Factor 3 was characterized by terms related to prominent political actors, elections, and taxes. These categories were found to be significant in explaining the variance captured by this component, thereby highlighting the importance of political events and fiscal policies in the uncertainty index.

Protests and social unrest were the primary contributors to Factor 4. This factor highlights the influence of public demonstrations and social movements on the perception of uncertainty. Finally, Factor 5 was defined by exogenous factors such as natural disasters. This component captures the influence of unforeseen external events on the overall uncertainty index, emphasizing the role of environmental and natural crises (Appendix 2).

4.2. EPUI Analysis

We present the results of the index construction and its correlation with events in the Ecuadorian context, which elucidate its behavior. Figure 6 presents the historical EPUI, which displays periods of relative stability and others of high uncertainty.

Figure 6. Evolution of EPUI
Index, 2004-2023



Source: Authors

As measured by the EPUI, 2005 was a period of political instability that followed the removal of former President Lucio Gutiérrez, during which time there were intense days of strikes in Ecuador's major city. Furthermore, it is essential to highlight the implementation of the 50/50 Law in the oil sector, which reformed the profit-sharing arrangements of private oil companies.

The transition of governmental leadership and the alteration of policy can have a profound effect on the business environment, investment decisions, and economic decision-making. In 2007, the presidential term of Rafael Correa Delgado began, as did Ecuador's reintegration into the Organization of Petroleum Exporting Countries (OPEC). Subsequently, in July 2009, the inaugural oil pre-sale contract was concluded with China. In this agreement, the state-owned oil company committed to sell eight monthly shipments of oil, with a total volume of 2,88 million barrels. In return, China advanced USD 1 billion. The decision to rejoin OPEC and the advance oil sales contract with China could have had a significant impact on Ecuador's economic policy, its oil industry, and its international relations. Consequently, the economic uncertainty and development of the country were significantly influenced.

In 2008, the Ecuadorian government ceased coupon payments on the Global 2012 bonds following an audit commission's determination that they constituted illegal and illegitimate debt. In particular, the country defaulted when the government of former President Rafael Correa suspended payments on the USD 3,2 billion Global 2012 and 2015 bonds. Subsequently, in 2009, the Ecuadorian government repurchased 91 % of the debt at a discount of 65-70 %. The impact of this default on a country that had been experiencing steady growth and had the capacity to pay its debts led to dissatisfaction among the international financial community, which in turn increased sovereign risk. When Ecuador issued bonds once more in 2014, the financial markets responded with higher interest rates.

Moreover, a noteworthy modification has been made in the oil exploitation contracts of Ecuador. Since 2010, negotiations have been conducted with private oil companies in accordance with the reforms of the Hydrocarbons Law. The government's objective was to conclude negotiations with these companies and transition to the service modality. The new contracts enabled the government to receive all the revenues generated by the production of crude oil from the oil fields. This represented a significant change in the distribution of oil revenues, with the state receiving a greater share of the profits generated by this important economic activity.

This modification to the oil exploitation contracts was designed to reinforce the country's sovereignty over its natural resources and to guarantee the state a higher level of revenue. This could have a positive impact on the management of public finances and reduce economic uncertainty regarding the rules of the game for investment in the oil sector.

On September 30 of the same year, there were strikes by the police in response to the approval of the Organic Law of the Public Service (LOSEP),

which revoked the benefits and recognitions previously granted to the police by the Assembly. Furthermore, this law also resulted in the transfer of the management of certain educational institutions from the National Police to the Ministry of Education. These developments gave rise to considerable unrest within the ranks of the National Police, with calls for the law to be repealed. The situation intensified when former President Rafael Correa proceeded to the Quito Regiment to address members of the police force, who forcefully rejected his presence and confronted him. The situation abated when Correa returned to the Carondelet Palace, where he declared the event an attempted coup.

The uncertainty surrounding the political situation in Ecuador increased significantly following the fear that the then President of the Republic would be overthrown. At the international level, there were also concerns about the possibility of a coup d'état, as evidenced by the extraordinary meeting of UNASUR convened at the time by the former President of Argentina, Néstor Kirchner. Consequently, these events increased the probability of a rise in country risk during these dates.

In 2015, Ecuador faced economic challenges related to the decline in oil prices and the devaluation of its trading partners' currencies, which placed significant pressure on the country's trade balance. Former President Rafael Correa perceived this as a significant long-term problem due to the magnitude of the devaluation. In response, the Ecuadorian government implemented safeguard measures on 32 % of imports (2.800 items) as a means of protecting the national economy. This type of mechanism could create a degree of uncertainty, especially for entrepreneurs and traders who depend on trade relations with specific product lines from different partners. The measure temporarily affected trade flows and raised concerns about market and price stability.

In the aftermath of this event, Ecuador was struck by an earthquake measuring 7,8 on the Richter scale on April 16, 2016. The epicenter was situated in an area between the cities of Cojimíes and Pedernales, in the province of Manabí. A total of 671 people perished, while only 113 Ecuadorians were rescued alive. The earthquake was one of the deadliest in South America since 1999, when an earthquake in Colombia killed 1.000 people.

In 2020, Ecuador was confronted with a challenging economic predicament, largely due to the decline in oil prices and the devaluation of the Colombian currency. To safeguard the economy and combat illicit trade, protective measures were implemented on Colombian imports. Additionally, the government underscored the significance of maintaining exchange rates and consistency in budget distribution, despite the economic challenges.

The global economy has experienced a significant contraction because of the coronavirus pandemic and the measures taken to contain it. A baseline scenario without the impact of the coronavirus pandemic (2019) indicates that total losses (public and private) in Ecuador between March and December

2020 amounted to USD 16.382 million, according to the Post Disaster Needs Assessment (PDNA) methodology.

The impact of the pandemic caused a significant increase in economic uncertainty in Ecuador, which manifested itself in several negative effects. These included economic contraction, a decline in tax revenues, pressure on the health system and public resources, an impact on employment and poverty, and financial and investment uncertainty.

The economic contraction was a direct consequence of the restrictions and closures imposed to contain the virus, which affected various sectors of the economy and businesses. Consequently, the decline in fiscal revenues, coupled with the fall in the price of crude oil and a decline in tax collection, made it challenging to finance public programs and services, intensifying concerns about fiscal sustainability. The pandemic also had a negative impact on employment and poverty, as a significant number of individuals lost their jobs or experienced a reduction in their income. This heightened the economic vulnerability of a significant proportion of the population, prompting concerns about the potential for increased poverty and inequality. The pandemic brought considerable economic uncertainty into the country, which in turn affected investor confidence and financial markets. This was reflected in a rise in asset price volatility and a general reluctance to make investment and financing decisions.

It is also important to note that economic uncertainty was heightened by the occurrence of national strikes. In October 2019, Ecuador faced a national strike of significant proportions, which was motivated by the government's decision to eliminate fuel subsidies. This decision led to strong discontent and protests in different cities. During the strike, thousands of citizens took to the streets to express their disagreement with the measure and demand a review of the government's economic policies. The protests had a significant impact on the country's economy and social stability, with road blockades and clashes between protesters and security forces. Eventually, the government and indigenous leaders reached an agreement to reverse the removal of fuel subsidies and end the strike, marking a significant turning point in Ecuador's political history. The mobilization's impact on the economy was estimated at USD 822 million (BCE & Banco Mundial, 2019).

The June 2022 strikes also had a significant impact on the country's economy. These protests caused an interruption of daily and productive activities, which had a macroeconomic effect of great magnitude. The result of these disruptions was a significant loss of USD 1.115 million, equivalent to 1 % of the country's current GDP (BCE, 2022).

These events, which were marked by extensive demonstrations, road-blocks, and confrontations between demonstrators and security forces, gave rise to a sense of political and social instability, which in turn affected citizen confidence, the productive sector, and investors' perception of the economic environment.

In 2023, the current president, Guillermo Lasso, was summoned to appear before the National Assembly for impeachment proceedings on May 16. The trial was based on the alleged crime of embezzlement for a contract between the public company FLOPEC and the Amazon Tanker Consortium. However, one day after the impeachment process began, Lasso declared the “Muerte Cruzada”, a constitutional mechanism that is activated in the event of serious internal unrest, which dissolves the National Assembly and calls for new presidential elections.

This has increased political instability and, therefore, economic uncertainty, as international investors lack a track record regarding the new government and its economic policies. It also reflects concerns about the government’s ability to service its external debt, especially in the medium term. These events have also been reflected in the recent increase in Ecuador’s country risk.

4.3. EPUI comparison with other uncertainty measures

To validate the behavior of the EPUI, this section presents a comparison with other relevant variables. These include country risk, as measured by the EMBI; the West Texas Intermediate (WTI) oil price; and the VIX Index, which reflects financial market volatility. Table 1 presents a correlation matrix among these variables.

Table 1. EPUI correlation matrix with other variables of interest

	EPUI	EMBI	VIX	WTI
EPUI	1			
EMBI	0,24	1		
VIX	0,11	0,73	1	
WTI	-0,37	-0,37	-1,0	1

Source: Authors

Note: Correlations were estimated from January 2004 to June 2023

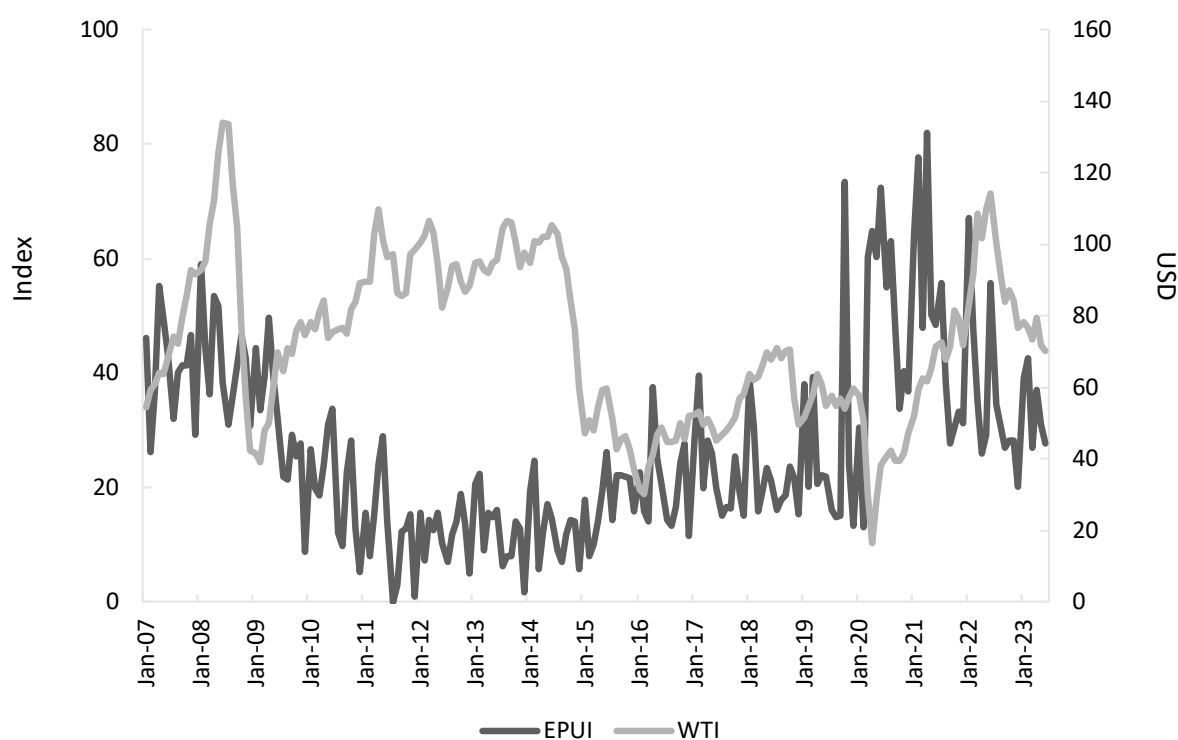
A noteworthy inverse correlation exists between the EPUI and WTI prices. This anticipated correlation indicates that as oil prices decline, the EPUI tends to increase. A comparison of the results with those obtained by Padilla (2019) reveals a higher correlation between our index and the one proposed by the author. This is evidenced by the fact that, in his study, the correlation between his EPU and WTI prices is -0,19.

Given Ecuador’s status as a petroleum-rich country with a high degree of dependence on the behavior of this commodity, lower oil prices can give rise to uncertainty about the state’s export revenue and, consequently, affect the financing capacity of investment projects. Furthermore, as petroleum exports

represent a substantial source of foreign exchange for the country, a decline in oil prices could give rise to concerns regarding the stability of the current account in the balance of payments. Conversely, when oil prices are elevated, the opposite occurs.

Figure 7 illustrates the correlation between these two variables. It is notable that, particularly during the period spanning 2009 to 2015, EPUI values are relatively low, while WTI prices tend to be high. A contrasting pattern can be observed in the year 2020, characterized by the pandemic, where EPUI peaks while WTI prices are observed to reach a nadir.

Figure 7. Evolution of EPUI and WTI prices
Index and USD/barrel, 2007-2023



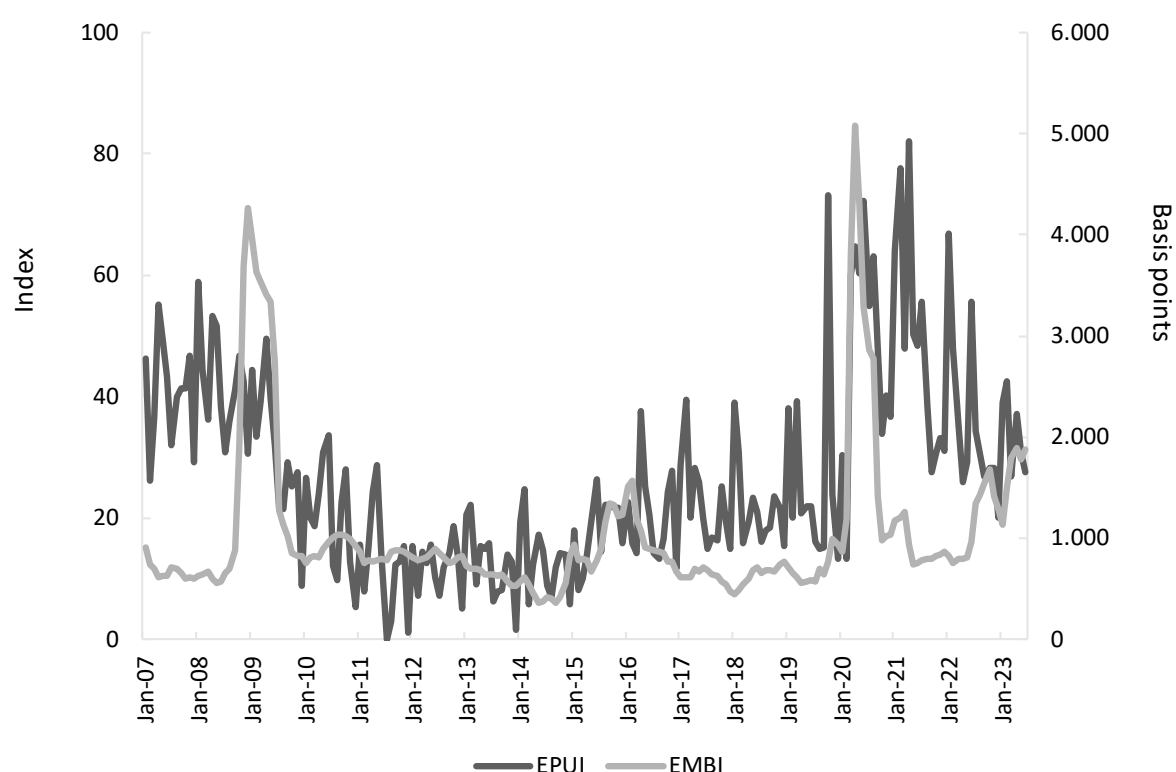
Source: Authors and Central Bank of Ecuador

Another variable of interest is country risk, as measured by the EMBI. This allows for the evaluation of a country's capacity to pay its debts. As this indicator exhibits elevated values, it can be inferred that the interest rates available to both the public and private sectors should also be elevated. The EMBI and EMBI+ are dynamic indices that reflect investors' perceptions of the credit risk of emerging markets. Hence, it is anticipated that a positive correlation will be observed between the EPUI and the EMBI, as illustrated in Figure 8.

The correlation coefficient between our measure of uncertainty and the EMBI is lower than that reported in Avellán et al. (2022), which achieved a correlation of 0,53. This discrepancy suggests that, while our uncertainty index is related to the EMBI, it captures different dimensions or nuances of economic uncertainty that are not fully aligned with those identified in Avellán's analysis. Further investigation is necessary to identify the factors contributing to this discrepancy.

Figure 8. Evolution of EPUI and EMBI

Index and basis points, 2007-2023

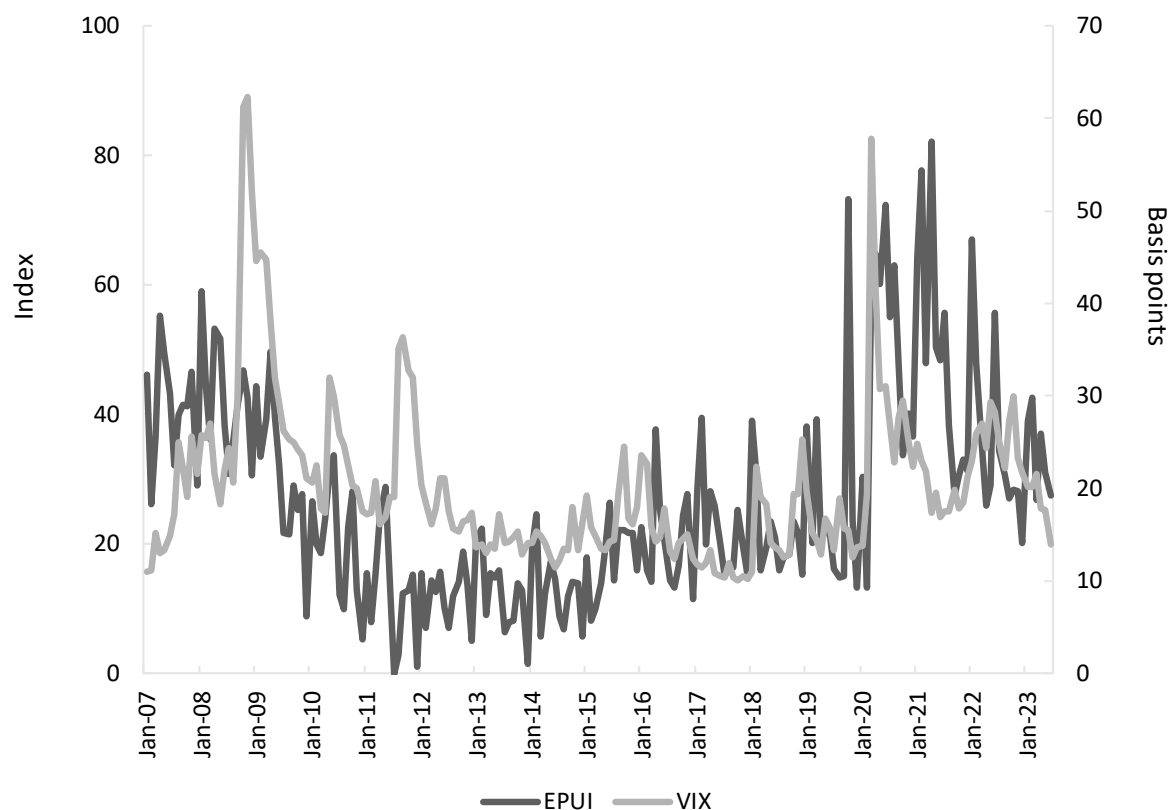


Source: Authors and Central Bank of Ecuador

Finally, the VIX index, which is often referred to as the “fear gauge,” serves as an indicator of market sentiment and investor fear. An increase in the VIX index is indicative of heightened uncertainty. Conversely, a decline in the VIX index is indicative of a more assured market environment. This index is employed to quantify volatility and risk within the financial markets.

Although it exhibits a lower correlation with EPUI than the two variables previously analyzed, it is important to note that the correlation remains positive, in line with our expectations. A comparison of the current findings to those presented by Padilla in 2019 reveals a markedly lower correlation coefficient (0,11 versus 0,34). This relationship is depicted in Figure 9.

Figure 9. Evolution of EPUI and VIX
Index and basis points, 2007-2023



Source: Authors and CBOE Global Markets

5. CONCLUSIONS

This paper presents an index for measuring political and economic uncertainty in Ecuador. The index draws upon open data from Google Trends, which provides information on relative searches for words related to specific dimensions of uncertainty, including elections, taxes, macroeconomic, political, and social factors.

The EPUI effectively captures moments of political and economic uncertainty in Ecuador, such as the overthrow of presidents, low oil prices, declaration of foreign debt default, social strikes, and others. Additionally, it demonstrates a correlation with other variables of interest, including country risk, the price of WTI, and the VIX index.

Future research could utilize this indicator to assess the impact of uncertainty innovations on the dynamics of other macroeconomic variables, such as output, employment, consumption, and investment. Furthermore, it could

examine the persistence of these shocks. Overall, this study establishes a foundation for a more comprehensive understanding of uncertainty in Ecuador. The utilization of novel technologies and data sources, such as Google Trends, presents an innovative and promising avenue for the analysis and monitoring of issues pertinent to economic agents, including uncertainty.

BIBLIOGRAPHY

- Ahir, H., Bloom, N., & Furceri, D. (2022). The World Uncertainty Index. National Bureau of Economic Research Working Paper Series, No. 29763. <https://doi.org/10.3386/w29763>
- Arbatli Saxegaard, E. C., Davis, S. J., Ito, A., & Miake, N. (2022). Policy uncertainty in Japan. *Journal of the Japanese and International Economies*, 64, 101192. <https://doi.org/10.1016/j.jjie.2022.101192>
- Avellán, G., González-Astudillo, M., & Salcedo Cruz, J. J. (2022). Measuring uncertainty: A streamlined application for the Ecuadorian economy. *Empirical Economics*, 62(4), 1517–1542. <https://doi.org/10.1007/s00181-021-02069-5>
- Bachmann, R., Elstner, S., & Sims, E. R. (2013). Uncertainty and Economic Activity: Evidence from Business Survey Data. *American Economic Journal: Macroeconomics*, 5(2), 217–249. <https://doi.org/10.1257/mac.5.2.217>
- Baker, S. R., Bloom, N., & Davis, S. J. (2016). Measuring Economic Policy Uncertainty*. *The Quarterly Journal of Economics*, 131(4), 1593–1636. <https://doi.org/10.1093/qje/qjw024>
- BCE. (2022). Evaluación de daños y pérdidas del Paro Nacional de junio de 2022 (71; Apuntes de Economía). <https://contenido.bce.fin.ec/documentos/PublicacionesNotas/Catalogo/Apuntes/ae71.pdf>
- BCE, & Banco Mundial. (2019). Evaluación de daño y pérdidas: afectaciones por Paro Nacional del 3 al 14 de octubre de 2019. https://www.bce.fin.ec/images/BANCO_C_ECUADOR/PDF/InformeBMImpactoParoNacional.pdf
- Bernanke, B. S. (1983). Irreversibility, Uncertainty, and Cyclical Investment. *The Quarterly Journal of Economics*, 98(1), 85. <https://doi.org/10.2307/1885568>
- Bilgin, M. H., Demir, E., Gozgor, G., Karabulut, G., & Kaya, H. (2019). A novel index of macroeconomic uncertainty for Turkey based on Google-Trends. *Economics Letters*, 184, 108601. <https://doi.org/10.1016/j.econlet.2019.108601>
- Castelnuovo, E., & Tran, T. D. (2017). Google It Up! A Google Trends-based Uncertainty index for the United States and Australia. *Economics Letters*, 161, 149–153. <https://doi.org/10.1016/j.econlet.2017.09.032>
- Cattell, R. B. (1966). The Scree Test For The Number Of Factors. *Multivariate Behavioral Research*, 1(2), 245–276. https://doi.org/10.1207/s15327906mbr0102_10

- Choi, H., & Varian, H. (2012). Predicting the Present with Google Trends. *Economic Record*, 88(s1), 2–9. <https://doi.org/10.1111/j.1475-4932.2012.00809.x>
- Donadelli, M. (2015). Google search-based metrics, policy-related uncertainty and macroeconomic conditions. *Applied Economics Letters*, 22(10), 801–807. <https://doi.org/10.1080/13504851.2014.978070>
- Ferrara, L., & Simoni, A. (2019). When Are Google Data Useful to Nowcast Gdp? An Approach Via Pre-Selection and Shrinkage. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3370917>
- Figuerola, C. (2014). Midiendo Incertidumbre Política Económica con Google y su Impacto en el Mercado Accionario: Evidencia Chilena.
- Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of Monetary Economics*, 32(3), 485–512. [https://doi.org/10.1016/0304-3932\(93\)90027-D](https://doi.org/10.1016/0304-3932(93)90027-D)
- Ghirelli, C., Pérez, J. J., & Urtasun, A. (2019). A new economic policy uncertainty index for Spain. *Economics Letters*, 182, 64–67. <https://doi.org/10.1016/j.econlet.2019.05.021>
- Guttman, L. (1954). Some necessary conditions for common-factor analysis. *Psychometrika*, 19(2), 149–161. <https://doi.org/10.1007/BF02289162>
- Jolliffe, I. T. (2002). *Principal Component Analysis* (2nd ed.). Springer-Verlag. <https://doi.org/10.1007/b98835>
- Jun, S.-P., Yoo, H. S., & Choi, S. (2018). Ten years of research change using Google Trends: From the perspective of big data utilizations and applications. *Technological Forecasting and Social Change*, 130, 69–87. <https://doi.org/10.1016/j.techfore.2017.11.009>
- Kaiser, H. F. (1960). The Application of Electronic Computers to Factor Analysis. *Educational and Psychological Measurement*, 20(1), 141–151. <https://doi.org/10.1177/001316446002000116>
- Kupfer, A., & Zorn, J. (2020). A Language-Independent Measurement of Economic Policy Uncertainty in Eastern European Countries. *Emerging Markets Finance and Trade*, 56(5), 1166–1180. <https://doi.org/10.1080/1540496X.2018.1559140>
- Lucas, R. E. (1973). Some International Evidence on Output-Inflation Tradeoffs. *The American Economic Review*, 63(3), 326–334. <http://www.jstor.org/stable/1914364>
- Ørmen, J. (2016). Googling the news. *Digital Journalism*, 4(1), 107–124. <https://doi.org/10.1080/21670811.2015.1093272>

- Padilla, S. (2019). Índice de Incertidumbre de Política Económica para Ecuador: discusiones y una propuesta de cuantificación. *Revista PUCE*, 108. <https://doi.org/10.26807/revpuce.v0i108.220>
- Pindyck, R. (1990). Irreversibility, Uncertainty, and Investment. National Bureau of Economic Research Working Paper Series, No. 3307. <https://doi.org/10.3386/w3307>
- Pratap, B., & Priyaranjan, N. (2023). Macroeconomic effects of uncertainty: a Google trends-based analysis for India. *Empirical Economics*, 65(4), 1599–1625. <https://doi.org/10.1007/s00181-023-02392-z>
- Shoag, D., & Veuger, S. (2016). Uncertainty and the geography of the great recession. *Journal of Monetary Economics*, 84, 84–93. <https://doi.org/10.1016/j.jmoneco.2016.11.002>
- Weinberg, L. (2020). The Google Trends Uncertainty (GTU) Index: A Measure of Economic Policy Uncertainty in the EU Using Google Trends. *Undergraduate Economic Review*, 17(1). <https://digitalcommons.iwu.edu/uer/vol17/iss1/2/>
- Woloszko, N. (2020). Tracking activity in real time with Google Trends. OECD Economics Department Working Papers, No. 1634.

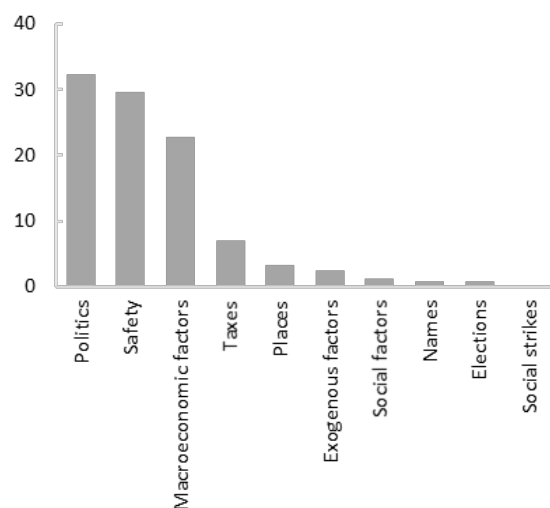
APPENDIX

Appendix 1. Words analyzed by category

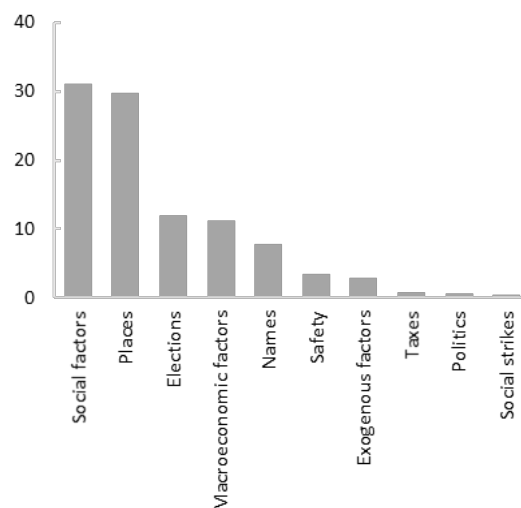
Places Esmeraldas, Frontera, Guayaquil	Elections Candidato, Consulta popular, Elecciones, Referéndum, Segunda vuelta, Votación, Votos
Exogenous factors Desastres naturales, Fenómeno de la niña, Fenómeno del niño, Terremoto, Volcán	Taxes Impuestos
Macroeconomic factors Crédito, Crisis, Crisis financiera, Default, Desempleo, Dolarización, Economía, Empleo, Finanzas, Gasolina, Inflación, Informalidad, Inversión, Petróleo, Salario mínimo, Subsidio, Trabajo	Social strikes Huelga, Marcha, Paro Nacional, Protesta
Names Guillermo Lasso, Lenín Moreno, Leonidas Iza, Rafael Correa	Social factors Confinamiento, Salud, Situación social
Politics Aceptación, Asamblea, Asamblea Nacional, CONAIE, Contrato, Corrupción, Decreto, Destitución, Estado, Estado de Excepción, Fiscalía, Gobierno, Golpe de estado, Juicio, Juicio político, Legislativo, Ministerio, Pachakutik, Peculado, Político, Presidente, Reforma, Toque de queda	Safety Armas, Cárceles, Inseguridad, Militares, Muertes violentas, Policías, Seguridad, Sicariato

Appendix 2. Contribution of Categories to Factors

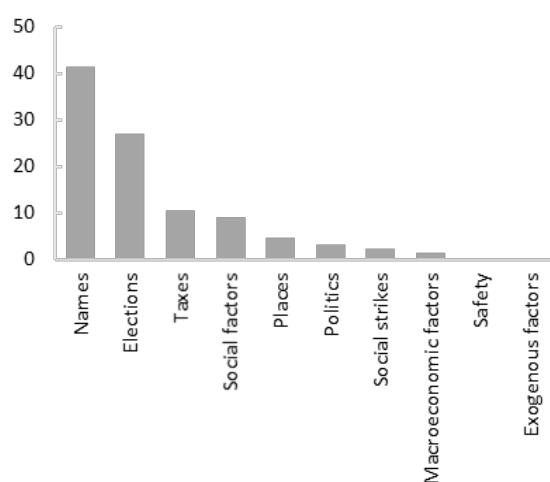
Factor 1



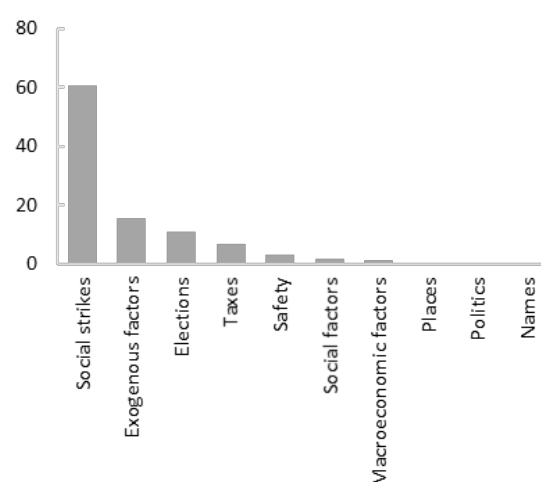
Factor 2



Factor 3



Factor 4



Factor 5

