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ECONOMIC UNCERTAINTY AND ITS EFFECTS IN BOLIVIA

Roger Alejandro Banegas Rivero[1]
Marco Alberto Nunez Ramirez[2+]
Irma Guadalupe Esparza Garcia[3]
Altayra Geraldine Ozuna Beltran[4]

[1]*Department of Economics, Gabriel Rene Moreno Autonomous University, Bolivia.*
[1]*Email: aleconomista@gmail.com*
[2,3]*Department of Management, Sonora Institute of Technology, Sonora, Mexico.*
[2]*Email: marco.nunez@itson.edu.mx*
[3]*Email: iesparza@itson.edu.mx*
[4]*Department of Management, University of Sonora, Sonora, Mexico.*
[4]*Email: altayra.ozuna@itson.edu.mx*


(+ Corresponding author)

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ABSTRACT

The paper's primary finding reveals that there are three factors related to the level of Bolivian economic uncertainty. These were interpreted as*: i) uncertainty of economic expectations; ii) uncertainty of monetary and exchange rate policy; iii) political and social uncertainty*. The contribution of each factor was found to account for approximately one-third of the total uncertainty; however, due to the incidence of the searches, the uncertainty factor in the monetary exchange rate policy showed greater contemporaneous synchronization with the general level by using multivariate techniques monthly for the period from January 2004 to December 2020. The estimated index captured negative variations for uncertainty during times of economic boom and growth, and it reflected positive variations of uncertainty in times of economic slowdown, low commodity prices, persistent fiscal and external deficits, as well as drops in net international reserves. Finally, by estimating a structural VAR model (SVAR), a direct relationship was found between global (external) economic uncertainty and domestic (internal) economic uncertainty, which slows national economic activity by -0.65%, interpreted as a retarding factor for economic growth.

Contribution/Originality: The fundamental contribution of this paper is oriented toward the construction and measurement of an index of economic uncertainty in Bolivia (IIEB), as well as the demonstration of the negative impact and the transmission channel from external economic uncertainty to the national economy.

1. INTRODUCTION

The main purpose of this document is to answer two questions: What are the factors that explain the level of economic uncertainty in Bolivia, and what is the role of external economic uncertainty, through domestic economic uncertainty, on economic activity?

For this purpose, a search index is employed using *Google Trends*, whose approach allows the capturing several *proxies* of economic uncertainty suggested in the literature (Bulut, 2018; Castelnuovo & Tran, 2017; Donadelli & Gerotto, 2019; Shields & Tran, 2019).

The data searches were carried out using keywords that capture the level of economic uncertainty in Bolivia for the period from 2004.01 to 2020.12. Factor analysis using principal components is carried out by means of data mining techniques and classification methods. Then, the hypothesis that the role of external economic uncertainty increases the level of internal economic uncertainty is tested.

Previous studies reflect economic uncertainty with negative repercussions on the main macroeconomic aggregates (Baker, Bloom, & Davis, 2016; Bloom, 2009; Huang & Luk, 2020; Moore, 2017). Likewise, the need to identify the sources generating uncertainty, especially for developing economies, has been raised as a research agenda in the measurement of internal uncertainty (Banegas, Vargas, & Caba, 2019) through keyword reduction, classification, clustering, or grouping techniques in the era of *Big Data* and *Data Mining* (Dai, Xiong, & Zhou, 2021; Müller & Hornig, 2020; Sorić & Lolić, 2017). To this end, the importance of public policies consists of the quantification of external and domestic economic uncertainty shocks in order to mitigate the retarding effects of economic growth.

The paper comprises five sections. The first contains the literature review related to the measurement of economic uncertainty and its respective impacts. In the second section, a bibliometric analysis is carried out with text mining techniques (*data mining*) to understand the main topics addressed, selected documents and trends in the theoretical and empirical perspectives of economic uncertainty. The third section explains the specification of the construction of an index of uncertainty in the Bolivian economy (IIEB) and the SVAR methodology for the quantification of effects. The fourth section contains the findings and results, the fifth section includes the discussion of the results, and the general conclusions of the paper are presented in the final section.

2. ECONOMIC UNCERTAINTY, MEASUREMENT AND IMPACTS

Recent literature on economic uncertainty provides greater emphasis from empirical evidence of its negative effect on economic activity, the level of employment, investment, and productivity. In the same way, the impacts of uncertainty have been seen in increased volatility on financial markets (Baker et al., 2016; Bloom, 2009).

Three measurement mechanisms of economic uncertainty have been identified; the first and most internationally referenced is a proxy Economic Policy Uncertainty (EPU) index for 26 selected countries with mostly advanced economies, including benchmark economies in Latin America (Brazil, Chile, Colombia and Mexico) as well as the Global Economic Policy Uncertainty (GEPU) index. The latter measures global economic policy uncertainty through a weighted average of GDP according to the EPU indexes of individual countries whose indexes have been constructed from keyword searches in thousands of newspaper articles, such as "economic", "economy", "uncertainty", "congress", "deficit", among others (other studies have used other words such as "budget", "central bank", "policy", "regulation", "spending" or "tax" (Brogaard & Detzel, 2015).

A second measure of economic uncertainty is through an index of volatility, prediction error or dispersion in the forecasts of a given number of macroeconomic variables. Disturbances in the forecasts are interpreted as the impossibility of prediction from the perspective of economic agents (Inekwe, 2020; Jurado, Ludvigson, & Ng, 2015). A third alternative measurement has been evidenced through internet search indexes, also called the Google Trends Uncertainty (GTU) indices. These statistics are freely available using other search terms such as "bankruptcies", "capital markets", "economic reforms", "debt stabilization", among others (Bontempi, Golinelli, & Squadrani, 2016; Castelnuovo & Tran, 2017). Economic uncertainty can be explained by assumptions regarding the irreversibility of investments and their returns; that is, uncertainty is explained by increasing the waiting time for new information or by delaying investments (Bernanke, 1983). Investors' expectations lead to consequences in aggregate investments and in the economic cycle.

Factors affecting economic uncertainty have also been identified, such as oil price shocks, which have an increasing effect on economic uncertainty and a negative effect on financial market returns (Kang & Ratti, 2013). Other factors of economic uncertainty are related to the timing of political elections. It is estimated that during

electoral periods, investment is reduced by around 4.8% in relation to non-election periods; therefore, political uncertainty is a relevant factor or transmission channel that reduces the level of investment and this affects the economic cycle (Julio & Yook, 2012). At the empirical level, the importance of measuring economic uncertainty leads to a related effect on the macroeconomic variables of inflation, unemployment, consumer confidence, economic activity and the financial market, usually through the use of VAR models, contemporaneously or with forward effects (Nowzohour & Stracca, 2020; Nyamela, Plakandaras, & Gupta, 2020).

3. BIBLIOMETRIC ANALYSIS OF ECONOMIC UNCERTAINTY

With the purpose of evaluating the major themes and trends in the literature related to economic uncertainty, a search was carried out in the Scopus bibliographic database related to three keywords that are linked to each other: Uncertainty, Economics and Impacts for the period from 1999–2020.

Filtering of refereed scientific journals in the area of Economics, Econometrics and Finance was carried out, specifically in scientific articles, from which 4099 articles were found, and after a subsequent filtering of the journals with better positioning in economics by citation order, 283 final documents were selected from text mining techniques in the titles of publications, authors, abstracts, keywords and bibliographic references. The results of the bibliometric analysis can be shown by graphs or visual representation. This is related to the most used keywords as proxies and related keywords in hierarchical order according to the frequency of observation (see Figure 1): uncertainty, economic policy uncertainty, economic uncertainty, uncertainty shocks, monetary policy, macroeconomic uncertainty, emerging markets, out-of-sample, innovation, global economic policy uncertainty, risk aversion, and forecasting.

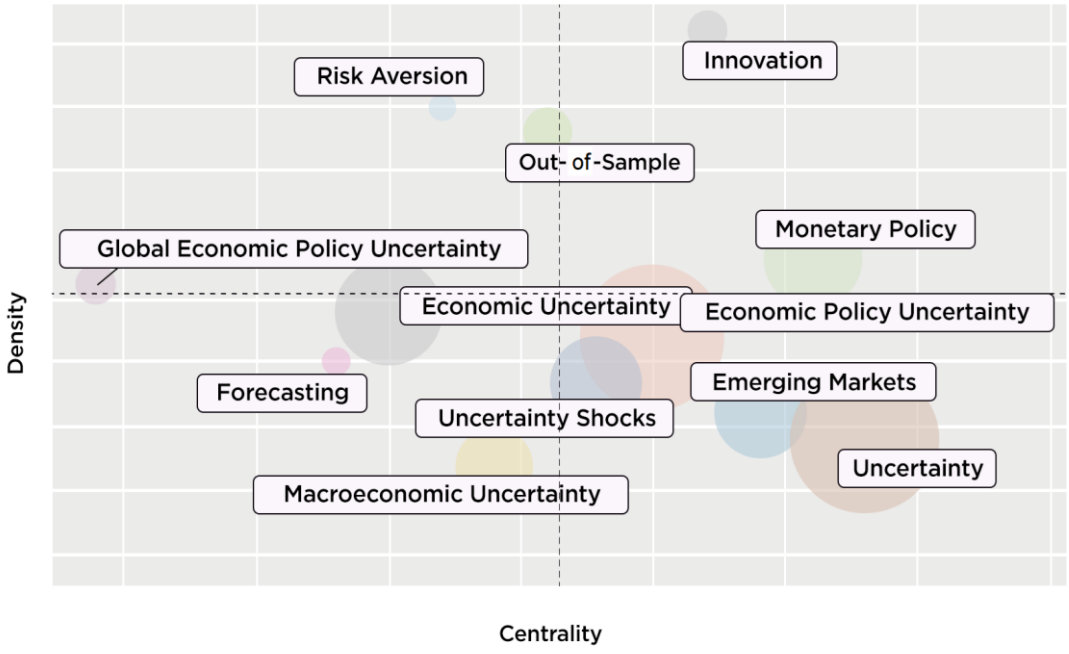

Figure 1. Keywords for economic uncertainty.

Similarly, by using a term grouping algorithm and multivariate techniques, a graphical representation is presented in terms of a dendrogram (see Figure 2). From this, it is possible to visually explain the groupings of monetary policy, uncertainty shocks, and economic uncertainty as the main ramifications.

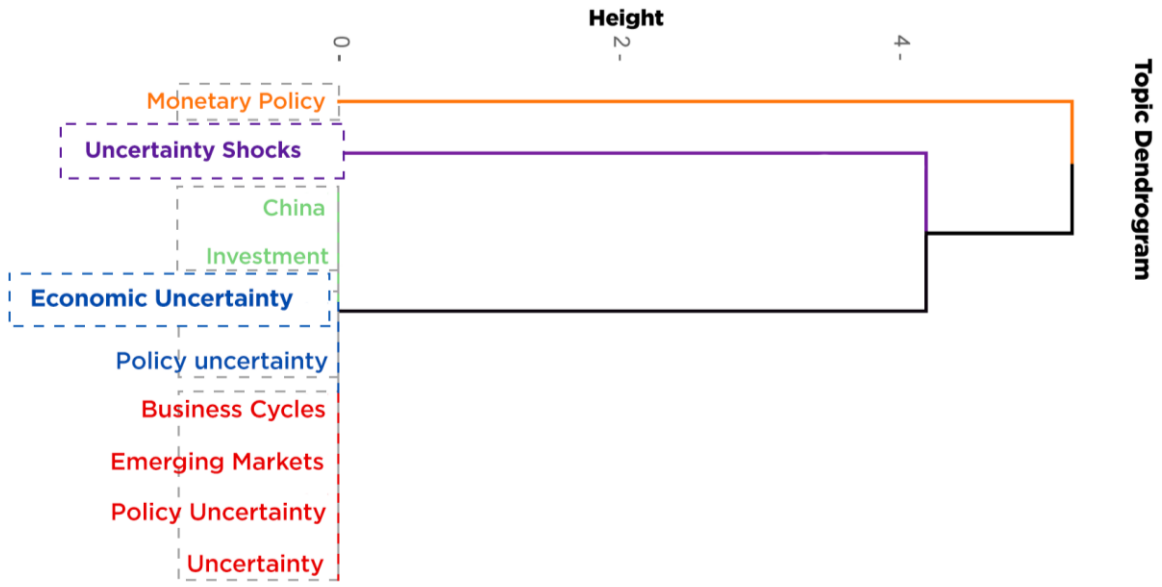

Figure 2. Classification of economic uncertainty by major themes.

From another perspective, considering the most cited papers in economic uncertainty literature, these are related to economic uncertainty, economic policy uncertainty, uncertainty shocks, investment, emerging markets and China (see Figure 3).

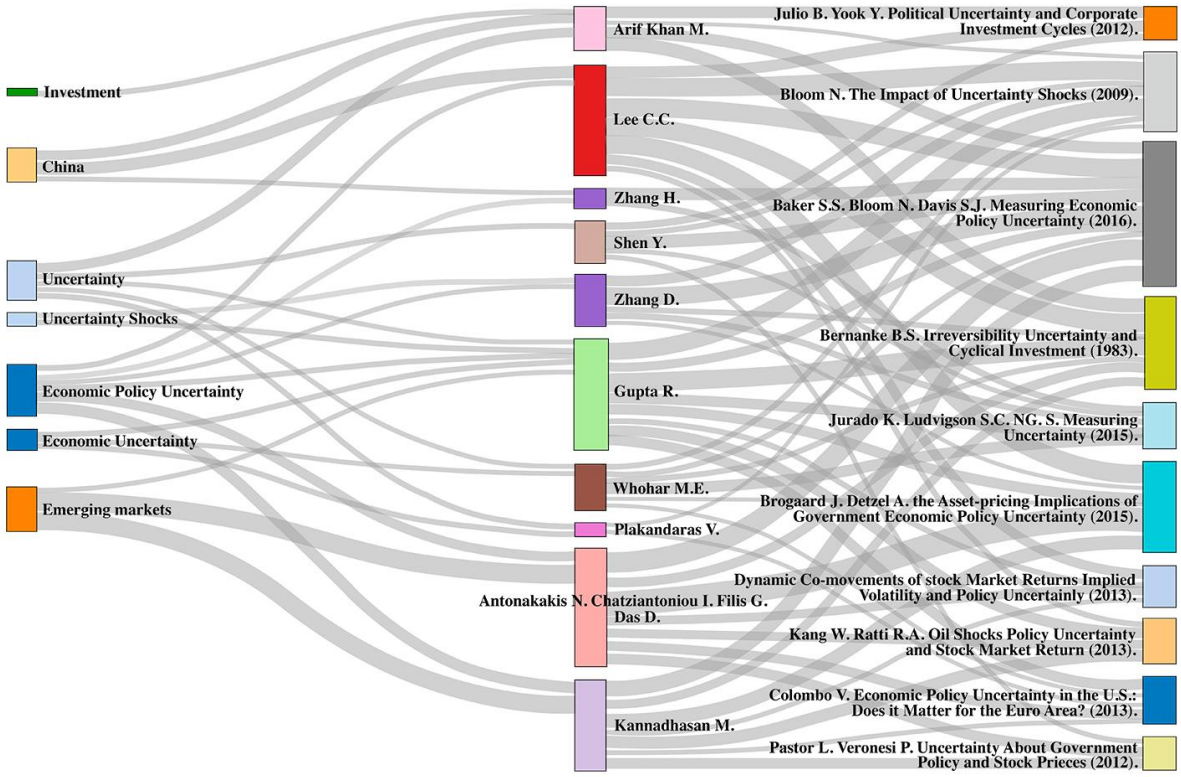

Figure 3. Selected papers on economic uncertainty.

Since 1999, evaluating the most frequent topics from a temporal perspective, the perspective of economic uncertainty, was linked to risk analysis; then, from 2009, the analysis of economic uncertainty shocks, policy uncertainty, monetary policy, the economic cycle and structural VAR analysis became relevant as a methodological

paradigm. In 2019 and 2020, economic uncertainty was linked to issues related to China and emerging markets, possibly due to the effects of the COVID-19 pandemic and its global implications (see Figure 4).

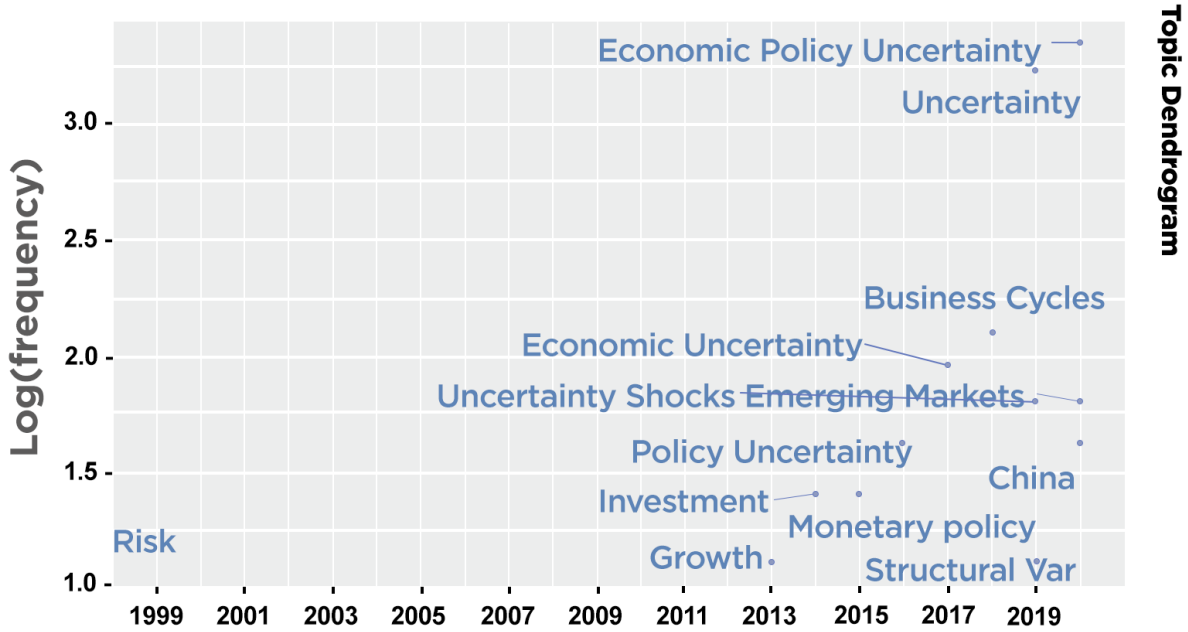

Figure 4. Trends in empirical and theoretical perspectives on economic uncertainty, 1999-2020.

In summary, the analysis using data mining techniques reflects the most frequent topics related to economic uncertainty or economic policy: the quantification of its shocks and the importance of monetary policy with a methodological paradigm in structural autoregressive vector models (SVAR) to assess the impacts on macroaggregates, with recent issues related to emerging economies and China, possibly in the context of 2019–2020.

4. SEARCH INDEX: A MEASURE OF ECONOMIC UNCERTAINTY FOR BOLIVIA (IIEB)

Google Trends was used to construct an index of economic uncertainty in Bolivia (IIEB). Its measurement was between 0 and 100 based on the number and frequencies of searches, with information available on a monthly basis since 2004. As a main limitation, the keywords may present variability in the sample according to the day of download (Choi & Varian, 2012), although there is a high correlation between the downloaded series (close to 0.97) (Bontempi et al., 2016).

Twenty-three keyword searches (x_{i_t}) were carried out from January 2004 to December 2020, with the intention of measuring four dimensions of uncertainty: fiscal policy, monetary and exchange rate policy, economic expectations, as well as political and social uncertainty (see Annex 1). For this purpose, the multivariate technique of factor analysis using principal components and orthogonal varimax rotation was used.

Consequently, the index of economic uncertainty in Bolivia $(IIEB_t)$ that is expressed in Equation 1 below was structured from each key search variable (x_{i_t}) by its respective weighting (w_i) according to the factors found with eigenvalues equal or greater than unity. This is also presented in Annex 2.

$$IIEB_t = \sum w_i x_{i_t} \quad (1)$$

As a grouping assumption, the dimensions that included at least three grouped factors were considered, and the respective weighting (w_i), was based on the commonality or variance shared among the variables (c_i), definitely, the search variable that shared the greatest variance with the rest of the factors or variables was considered to be the most relevant as it is represented in expression 2:

$$w_i = \frac{c_i}{\sum_{i=1}^{j} c_i} * 100 \quad \forall i = 1, 2, 3 \ldots . . j \qquad (2)$$

Based on 1 and 2, the economic uncertainty index for Bolivia was constructed, explaining about 53% of the cumulative variance of the variables (Annex 2B).

When considering an index of economic uncertainty in Bolivia (IIEB), an SVAR model with a vector of four endogenous variables (z_t) was subsequently estimated for the Bolivian economy from 2004:Q1 to 2020: Q3 on a quarterly basis (Q). In Equation 3, with respective ordering according to the level of theoretical exogeneity assumed in the shocks, the first is the most exogenous, while the last is the one with the greatest response or dependence.

The variables were modeled in a stationary sense $\{I(d)\}$ according to the augmented Dickey–Fuller (ADF) unit root test (see Annex 3) following (Banegas et al., 2019):

$$z_t = \{\Delta \log(GEPU), \log(VIX), \log(IIEB), \Delta \log(y)\} \qquad (3)$$

Where "$\Delta \log(GEPU)$" represents the percentage change in the measured Global Economic Policy Uncertainty (GEPU), obtained from Economic Policy Uncertainty Index; "$\log(VIX)$" symbolizes a measure of international financial volatility through the logarithm which represents the 30-day forward expectations in volatility derived from S&P 500 options according to the Chicago Board Options Exchange (CBOE), which was obtained from Yahoo! Finance; and $\log(IIEB)$ represents the index of economic uncertainty in Bolivia and the variation in the economic activity index $(\Delta \log(y))$ obtained from the National Institute of Statistics (INE). A VAR model with three lags was estimated according to the Akaike information criterion that met all the econometric specification tests (see Annex 4) according to short-term estimates, normal multivariate residuals, non-heteroscedasticity, and non-autocorrelation problems (see Annexes 4a, 4b, 4c, 4d and 4e, respectively). The model is stable as there are no inverse roots outside the unit circle (see Annex 4f).

4.1. SVAR Model Specification

The purpose of the structural vector autoregression (SVAR) is to explain the determinants of shocks to global economic policy uncertainty, international financial volatility and economic uncertainty in Bolivia. This required the definition of unobservable and exogenous structural innovations, as well as the inclusion of economic restrictions in the model. The moving average structural representation of the vector is as follows:

The SVAR proposal suggests recovering the structural vector shock $(\mu_t^{z_i})$, which is not directly observable, from the estimation of an unrestricted VAR. This VAR is invertible and generates the following moving average representation:

$$z_t = A(L)\, \varepsilon_t^{z_i} \quad (4)$$

Where $A(L)$ represents a parameter operator, and $\varepsilon_t^{z_i}$ denotes the reduced form vector of residuals with covariance matrix Σ in 4.

A linear relationship is established between the reduced form of the residuals and the structural model shocks 5:

$$\varepsilon_t^{z_i} = \beta_0\, \mu_t^{z_i} \quad (5)$$

Thus, it is necessary to identify the matrix $C_0\ (4x4)$ in order to recover the vector of structural shocks $(\mu_t^{z_i})$ from the vector of estimated errors $(\varepsilon_t^{z_i})$. Otherwise, the unrestricted VAR could be symbolized as 6:

$$z_t = A^{-1}C(L)\, z_t + A^{-1}\, B\, \varepsilon_t^{z_i} \quad (6)$$

Where the stochastic error is normally distributed, $\varepsilon_t^{z_i} \sim N(0,1)$, and A, B, C are separately unobservable matrices (the idea is to impose long-run restrictions on the unrestricted VAR to recover the structural form of the model $A\, z_t = C(L)\, z_t + B\, \varepsilon_t^{z_i}$, which cannot be estimated directly due to identification problems).

By regrouping the terms of 6, we get 7:

$$(I - A^{-1}\, C(L))z_t = A^{-1}\, B\, \varepsilon_t^{z_i} \quad (7)$$

After some algebraic manipulations and combining 7 with 5 and 6, 8 is obtained:

$$[A] * \varepsilon_t^{z_i} = [B] * \mu_t^{z_i} \quad (8)$$

Matrix A corresponds to the contemporaneous effects (automatic stabilizers and/or instantaneous responses) of observed innovations $\{\varepsilon_t^{z_i}\}$. In B, restrictions are imposed to capture the reaction of international economic uncertainty, international financial volatility and economic uncertainty in Bolivia, i.e., how it responds to unexpected shocks and structural innovations $\{\mu_t^{z_i}\}$.

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ -\alpha_{21} & 1 & 0 & 0 \\ -\alpha_{31} & -\alpha_{32} & 1 & 0 \\ -\alpha_{41} & -\alpha_{42} & -\alpha_{43} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_t^{\Delta \log(GEPU)_t} \\ \varepsilon_t^{\log(VIX)_t} \\ \varepsilon_t^{\log(IIEB)_t} \\ \varepsilon_t^{\Delta \log(Y)_t} \end{bmatrix} = \begin{bmatrix} \beta_{11} & 0 & 0 & 0 \\ 0 & \beta_{22} & 0 & 0 \\ 0 & 0 & \beta_{33} & 0 \\ 0 & 0 & 0 & \beta_{44} \end{bmatrix} * \begin{bmatrix} \mu_t^{Inc.Econ.global_t} \\ \mu_t^{Vol.Finan.Internc._t} \\ \mu_t^{Inc.Econm.Domést._t} \\ \mu_t^{Act.Econ.Nal._t} \end{bmatrix} \quad (9)$$

In this sense, economic theory is used as a starting point to impose the following restrictions that allow obtaining an identified model with k variables and symmetry properties that impose restrictions $\left(\frac{k(3k-1)}{2}\right)$.[ξ]

[ξ] Since four endogenous variables (k = 4) are considered, 22 zero constraints are required in matrices A and B, respectively. Since B is considered as a diagonal matrix with 12 coefficients equal to zero, matrix A needs 10 restrictions; therefore, four correspond to unity and six coefficients equal zero.

For this purpose, Equation 9 presents the following contemporaneous effects, which were assumed recursively in the A matrix:

1) Global economic uncertainty innovations are completely exogenous: in the short run; they only respond to their own innovations $(\alpha_{12} = \cdots = \alpha_{14} = 0)$, three constraints.

2) The innovations of international financial volatility respond to the innovations of global economic uncertainty and its own shocks $(\alpha_{23} = \alpha_{24} = 0)$, two constraints in the short run.

3) The impact of innovations in global economic uncertainty and international financial volatility on shocks of economic uncertainty in Bolivia $(\alpha_{34} = 0)$, a short-term constraint.

4) The innovations of the variation in national economic activity to all structural shocks incorporated in the system in the short run is the variable with the highest level of endogeneity in the response in an unrestricted way.

5. FINDINGS AND RESULTS

Consistent with the results of the estimations using the factor analysis technique, three factors or components were found under the criterion of eigenvalues greater than unity, which would cumulatively explain 53% of the originally grouped variables (see Annex 3).

According to the principal component factor analysis, economic uncertainty in Bolivia is interpreted in its composition by three factors: 1) uncertainty of economic expectations; 2) uncertainty of monetary and exchange rate policy; 3) political and social uncertainty (see Figure 5).

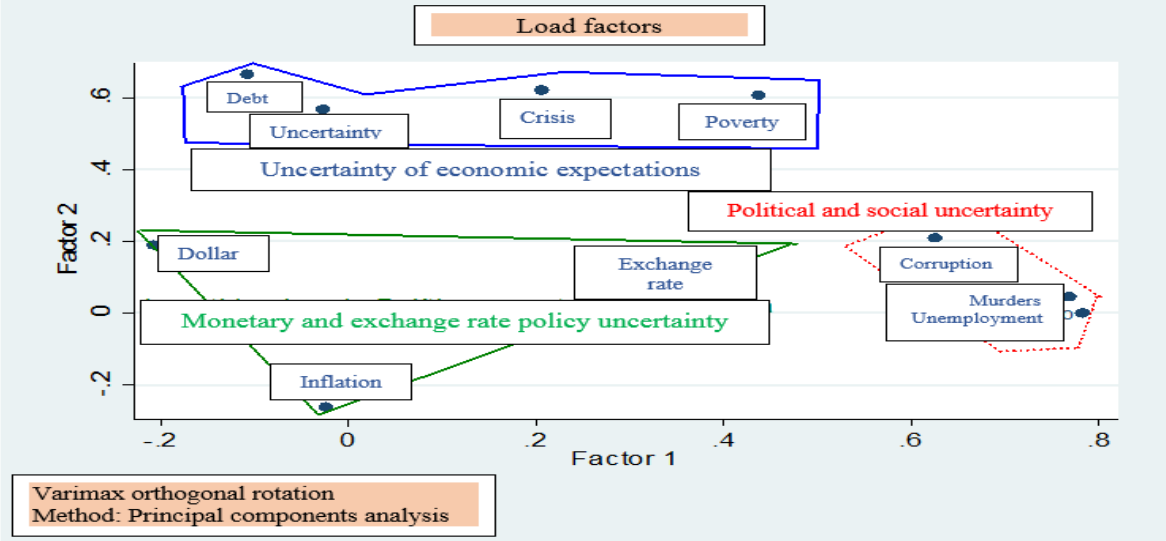

Figure 5. Selection of the number of factors for the construction of the economic uncertainty index in Bolivia (IIEB) (2004.01–2020.12).

Table 1. Analysis of correlations between factors related to the IIEB (monthly data).

Factors	IIEB	Uncertainty of Economic Expectations	Monetary and Exchange Rate Policy Uncertainty	Political and Social Uncertainty
IIEB	1			
Uncertainty of Economic Expectations	0.57***	1		
Monetary and Exchange Rate Policy Uncertainty	0.66***	0.02	1	
Political and Social Uncertainty	0.64***	0.35***	0.07	1

Note: *** denotes statistical significance at the 1% level.

Table 2. Analysis of correlations between IIEB-related factors Quarterly data, in 12-month variation.

	Quarterly data, 12 Month Variation			
Factors	**Δ IIEB**	**Δ Uncertainty of Economic Expectations**	**Δ Monetary and Exchange Rate Policy Uncertainty**	**Δ Political and Social Uncertainty**
Δ IIEB	1			
Δ Uncertainty of Economic Expectations	0.71***	1		
Δ Monetary and Exchange Rate Policy Uncertainty	0.87***	0.55***	1	
Δ Political and Social Uncertainty	0.36***	0.24*	0.21	1

Note: *** and * denote statistical significance at the 1% and 10% levels, respectively.

According to Table 1, the index of economic uncertainty in Bolivia, would be positive and significantly correlated with the uncertainty of monetary and exchange rate policy ($r = 0.66$), political and social uncertainty ($r = 0.64$) and uncertainty of economic expectations ($r = 0.57$) in a statistically significant way.

For quarterly data with 12-month variations, the IIEB index would be more contemporaneously synchronized with monetary and exchange rate policy uncertainty ($r = 0.87$) in the first instance, followed by economic expectations uncertainty ($r = 0.71$), and political and social uncertainty ($r = 0.36$), respectively, and statistically significant at the 0.01 level (see Table 2). Similarly, according to Bartlett's test of specificity and the KMO test, it was concluded that it was pertinent to perform the factor analysis for the grouping of the variables. The factor results identified for the IIEB index indicated that the dimensions found showed equal importance of weightings of about one-third respectively on the IIEB index (see Table 3).

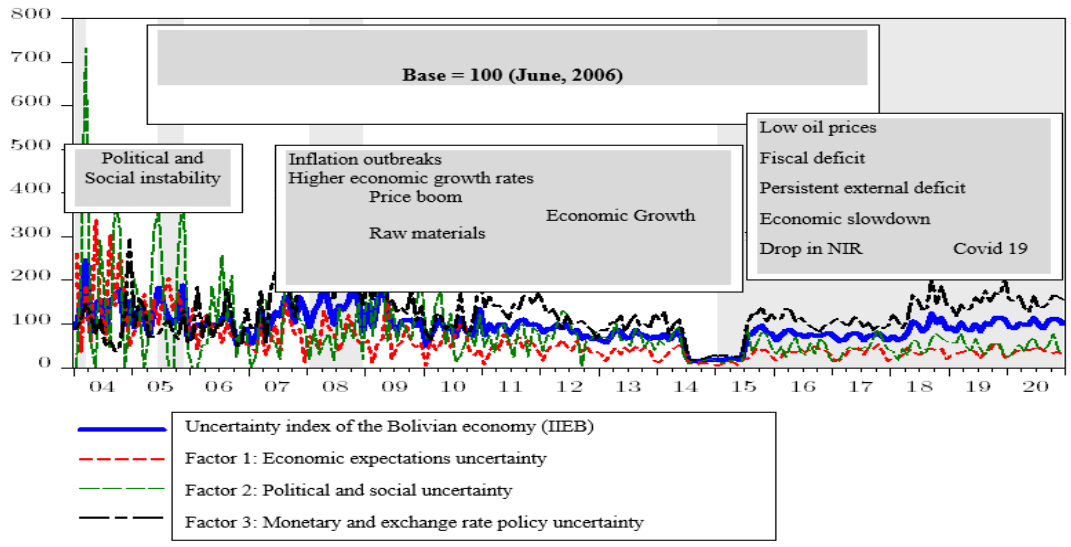

Figure 6. Uncertainty index of the Bolivian economy (IIEB, 2004–2020).

Table 3. Construction of the uncertainty index of the Bolivian economy.

							Factors of the Uncertainty Index of the Bolivian economy (IIEB)		
Search in Google Trends	**Factor 1**	**Factor 2**	**Factor 3**	**Uniqueness**	**Communality**	**Index Weighting**	**Political and Social Uncertainty**	**Uncertainty of Economic Expectations**	**Monetary and Exchange Rate Policy Uncertainty**
Crisis	0.21	0.62	0.27	0.50	0.50	9%		9%	
Uncertainty	-0.03	0.57	0.06	0.67	0.33	6%		6%	
Debt	-0.11	0.67	-0.03	0.54	0.46	9%		9%	
Poverty	0.44	0.61	-0.07	0.44	0.56	11%		11%	
Inflation	-0.02	-0.26	0.70	0.44	0.56	11%			11%
Exchange Rate	0.34	0.14	0.72	0.34	0.66	12%			12%
Dollar	-0.21	0.19	0.72	0.41	0.59	11%			11%
Unemployment	0.78	0.00	0.15	0.37	0.63	12%	12%		
Murders	0.77	0.04	-0.01	0.41	0.59	11%	11%		
Corruption	0.63	0.21	-0.14	0.55	0.45	8%	8%		
Total					5.34	100%	31%	35%	34%

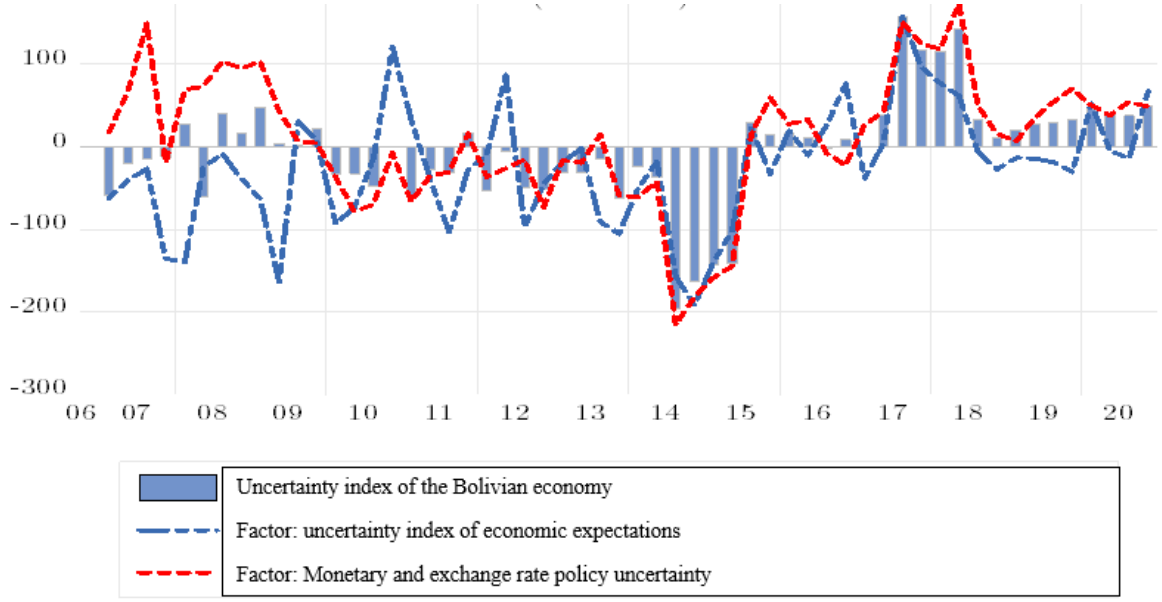

Figure 7. 12-month variations of economic uncertainty in Bolivia and its components (2006–2020).

When evaluating recent economic history, the IIEB index allows us to appreciate the movements related to some events of greater uncertainty, such as periods of political and social instability (2004–2005) and inflationary outbreaks (2008) from a monetary perspective.

On the other hand, there is a concordance of negative variations in the index of economic uncertainty in Bolivia (IIEB) in relation to periods of higher economic growth rates, booming commodity export prices (Banegas, Núñez, & Valdez, 2020), and increased international reserves and economic bonanza. Consequently, a negative variation of economic uncertainty was estimated at around -45% per year for the 2010–2014 period.

From 2015:Q2 to 2020:Q1, the annual variation of uncertainty was higher than 40% per year, in a context characterized by periods with low oil prices, twin deficits (fiscal and external), falling international reserves and a period of economic slowdown with a decrease in the growth rate of the potential output of the Bolivian economy (Banegas, 2016), which increased the levels of uncertainty. Likewise, it reflected higher levels of variation during the COVID-19 pandemic (Figures 6 and 7).

Equally, the highest variation of the IIEB was observed during 2017–2018, with rates around +80% per year that are directly related to monetary and exchange rate policy uncertainty, which resulted in an increase of +140% for the same period; likewise, in the COVID-19 context (2020), the 12-month average variation of the economic uncertainty index in Bolivia (IIEB) was around +40%. Overall, two- and three-digit variations were observed in the cases indicated in the change in the level of domestic uncertainty.

Once the index of economic uncertainty in Bolivia (IIEB) was identified and constructed, the impulse response functions were analyzed by means of a short-term SVAR model in order to evaluate the effects of global economic uncertainty and international financial volatility, with a transmission channel through the uncertainty of the Bolivian economy (IIEB) to the level of national economic activity.

When evaluating the results of the impulse response function (IRF), a short-term structural shock or standard deviation in global economic uncertainty (GEPU) directly affects the increase in international financial volatility (VIX) between 0.1% and 0.2% in a forward quarter (see Figure 8a); similarly, it increases domestic uncertainty (IIEB) by between 0.01% and 0.11% (see Figure 8b).

Finally, according to Figure 8c, an economic uncertainty shock in Bolivia (IIEB) decreases the country's economic activity by between -0.1% and -0.65% in a forward quarter in a statistically significant way; similarly, a

structural shock of global economic uncertainty affects the national economic activity by between -0.02% and -0.61% in a forward quarter.

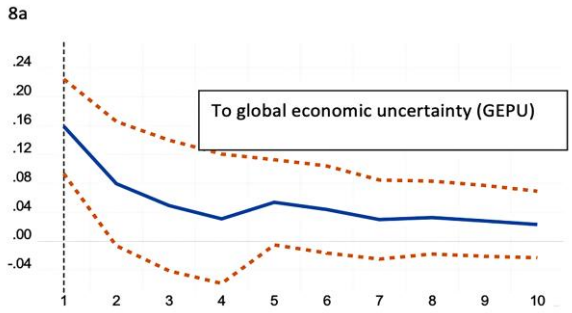

Figure 8a. International financial volatility response (VIX).

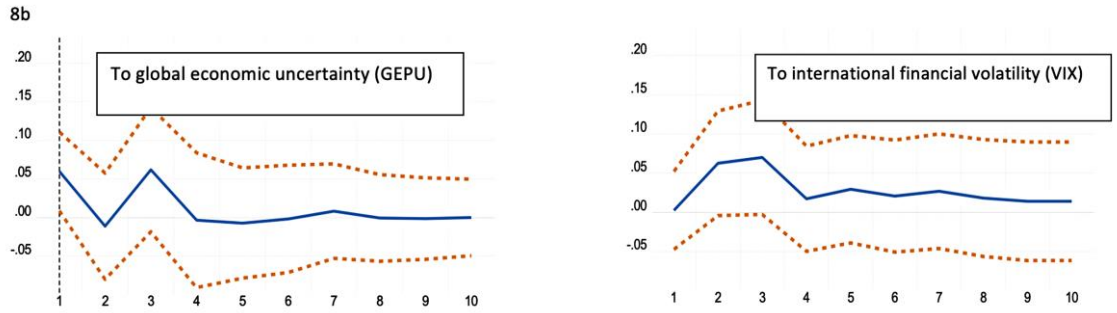

Figure 8b. Response of economic uncertainty in Bolivia (IIEB).

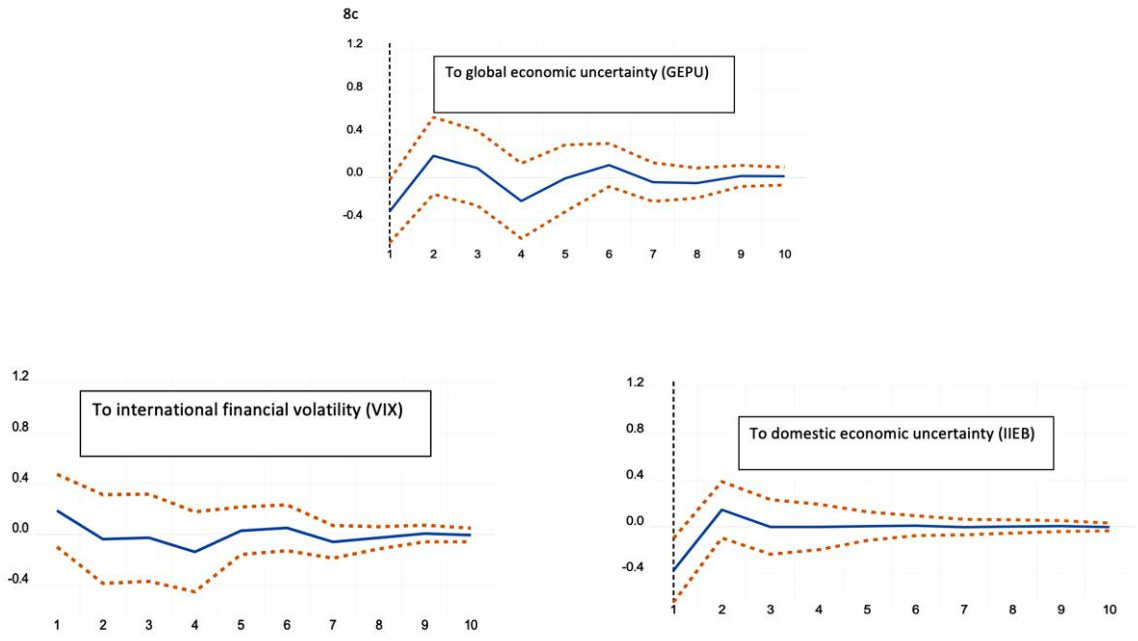

Figure 8c. Response in the growth of national economic activity (Var % Y).
Figure 8. Impulse response function (IRF) of a short-term SVAR model (in forward quarters).

Furthermore, there is empirical evidence that global external economic uncertainty increases economic uncertainty in Bolivia, and this, in turn, negatively affects the country's economic activity in a statistically significant way as a transmission channel.

6. DISCUSSION OF RESULTS

Fundamentally, search patterns are related to uncertainty in the sense of an information structure, not only considering the past or present time, but also towards the future, especially for consumption or investment in terms of making decisions without the possibility of change, without alternatives (irreversible), or postponing decision making, leaving other possibilities open (non-irreversible) (Arrow & Fisher, 1974; Henry, 1974).

Usually, under conditions of certainty or assurance, decisions are made assuming certainty about the desired end result; in contrast, under conditions of uncertainty, decisions have to be transferred to the future (no consumption today, no investment), since higher profits or lower losses are assumed depending on the search for information over time. This explains the negative impact of uncertainty on economic activity.

In contrast, when comparing the findings with previous studies, there is evidence of empirical consistency where global economic uncertainty increases international financial volatility (Baker et al., 2016; Bloom, 2009). Similarly, there is an affinity with studies for which external uncertainty negatively affects domestic output, especially for the Bolivian economy (Banegas et al., 2019).

As a transmission channel, it is consistent with the evidence of the direct relationship between external economic uncertainty and increased domestic economic uncertainty, and with negative impacts on domestic economic activity (Stockhammar & Ostherholm, 2016; Stockhammar & Östherholm, 2017).

From a multivariate perspective, macroeconomic uncertainty is the result of heterogeneous unobserved components. For this, the use of searches through Google Trends allows the identification of the pattern of concerns, traffic intensity, and interests of economic agents of a particular country as a source of information, interpreted and related to uncertainty (Bontempi et al., 2016).

6.1. Public Policy Implications

Among the main implications for public policies, the central suggestion is to reduce the levels of economic uncertainty in its three dimensions or factors, considering the negative effect of economic uncertainty on economic activity.

Firstly, in the factor related to the uncertainty of economic expectations, debt stands out as a proxy measure of uncertainty and volatility of fiscal policy with an adverse effect on economic activity (Fernández-Villaverde, Guerrón-Quintana, Kuester, & Rubio-Ramírez, 2015). Fundamentally, for this dimension, the search engines of risk and uncertainty, whose variables are relevant for investment decisions, are included.

From the dimension of monetary and exchange rate policy uncertainty, the uncertainty index reflects greater increases in times of higher inflationary levels and in periods of falling net international reserves or expectations of devaluation in the local currency with respect to the foreign currency; therefore, this factor focuses on the path of inflation and the value of the dollar or exchange rate as the target indicators for stability or to reduce inflationary and exchange rate uncertainty (Mueller, Tahbaz-Salehi, & Vedolin, 2017).

From the political and social dimension, the greatest relevance revolves around unemployment, murders and the level of corruption, consistent with empirical evidence that the perception of corruption and criminality positively affect uncertainty and its transmission in macroeconomics (Detotto & Otranto, 2010; Gründler & Potrafke, 2019; Julio & Yook, 2012; Sorić & Lolić, 2017).

In short, these factors must be addressed and controlled with specific programs and goals, which imply the design of action plans to generate certainty and promote stability and growth, especially in the context of crisis or for the purpose of economic reactivation.

Likewise, the variation of the economic uncertainty index and its related factors differ in magnitude when compared to other indicators (inflation, unemployment, growth, etc.), usually with one-digit changes. In contrast, the variations of uncertainty are interpreted in greater volatility with usual changes between two and three digits,

which reveals the importance of the searches and concerns of economic agents in periods of instability (high searches) or in periods of tranquility (low frequency searches).

6.2. Limitations and Agenda for Future Research

One of the main limitations of the uncertainty index, based on internet searches, is oriented to the level of development of human capital in its economic agents: interest, degree of concern and education to be informed; hypothetically, the search index for the identification of proxy measures of uncertainty could work with greater capture in the unobserved variable in advanced economies compared to developing economies. This reflects an intrinsic limitation in the methodology used.

As a research agenda for future studies, the complementation of a validity analysis by alternative quantifications is needed to appreciate the consistency in the conclusions and results in the measurement of internal economic uncertainty or synthetic construct, e.g., mining of economic news, mining of social networks (Facebook and Twitter pages), subjective survey of expectations, forecast dispersion or forecast error among specialized agencies, and measures of internal financial volatility as a proxy for internal economic uncertainty (Altig et al., 2020; Baker, Bloom, Davis, & Terry, 2020; Ghirelli, Gil, Pérez, & Urtasun, 2021).

7. GENERAL CONCLUSIONS

Two research questions were posed in this paper. The first question focused on the factors related to economic uncertainty in Bolivia, and the second question related to the role of external economic uncertainty and its impact on economic activity through domestic economic uncertainty.

To respond to the first approach, three factors were found to generate economic uncertainty*: i) uncertainty of economic expectations; ii) uncertainty of monetary and exchange rate policy; iii) political and social uncertainty.* According to the factor analysis technique by the principal component method, each factor contributed approximately one-third of the total uncertainty. However, due to the frequency of searches, the highest contemporaneous synchronization of the index is related to the monetary and exchange rate policy uncertainty factor.

For the second question, it was shown that external (global) economic uncertainty increases domestic economic uncertainty in a statistically significant and unidirectional way (up to +.11% in a forward quarter), and global uncertainty reduces national economic activity up to -0.6%. Likewise, it was evidenced that domestic economic uncertainty reduces national economic activity by up to -0.65% with a significant impact one quarter forward after the shock has occurred.As a secondary objective and by means of text mining techniques (bibliometric analysis), a selected review was carried out of 283 articles related to economic uncertainty, a thematic trend that originated in advanced economies and is migrating towards emerging economies and China, especially in the context of the recent COVID-19 pandemic. The methodological paradigm in the quantification of economic uncertainty impacts continues to be based on SVAR models. On the other hand, the variation of the economic uncertainty index in Bolivia (IIEB) allowed the capture of negative variations in times of economic boom and growth (2010–2014) and positive variations of uncertainty in times related to economic slowdown, low commodity prices, persistent fiscal and external deficits, as well as drops in net international reserves (2015–2020). Unlike other macroeconomic indexes, the proposed index of economic uncertainty for Bolivia is characterized by variations above two and three digits, respectively, with persistent shock movements, random upward or downward trends, which are relevant for public policy, especially for monitoring and neutralizing negative expectations that affect economic uncertainty and its negative effects on economic activity.

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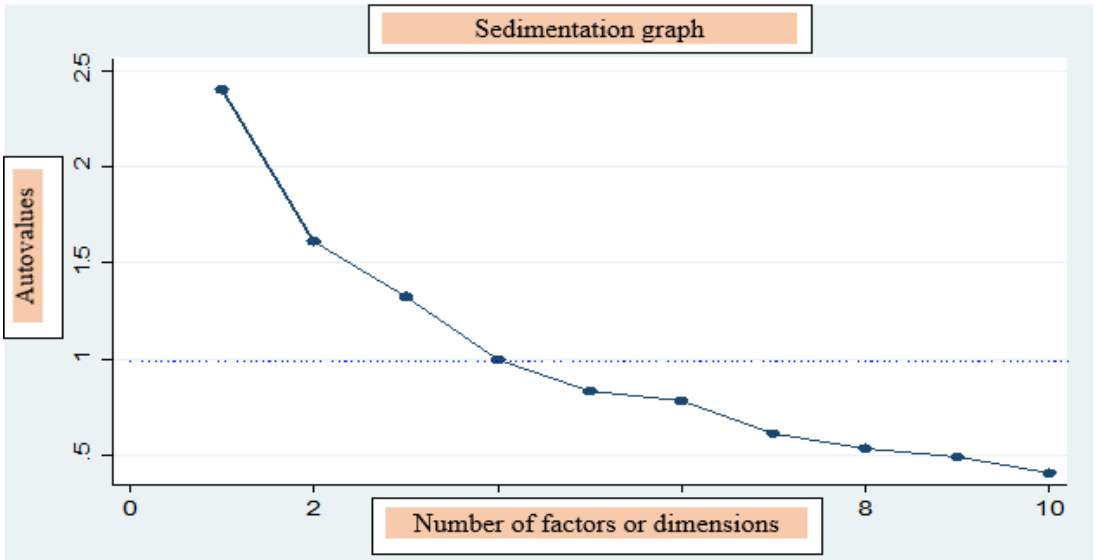
Annex 1. List of search proxies for uncertainty by clustering themes in Google Trends (search index).

(1) Fiscal policy uncertainty – Fiscal deficit – Debt	**(2)** Monetary and exchange rate policy uncertainty – - Inflation – - Exchange Rate – - Dollar – - NIR
(3) Political and social uncertainty – - Unemployment – - Inequality – - Blockades – - Stockouts – - Strikes – - Protests – - Violence – - Vulnerability – - Robberies – - Murders – - Drug trafficking – - Corruption	**(4)** Uncertainty of economic expectations – - Crisis – - Risk – - Uncertainty – - Recession – - Poverty

Annex 2. Identification of factors.



Annex 2a. Selection of the number of factors for the construction of the index of economic uncertainty in Bolivia (IIEB) (2004.01–2020.12).

Annex 2b. Analysis of variance among the factors.

Method: Principal component factors			Number of obs. = 204	
Orthogonal Varimax rotation			Retained factors = 3	
Factor	**Variance**	**Difference**	**Proportion**	**Cumulative**
Factor1	1.998	0.301	20%	20%
Factor2	1.688	0.032	17%	37%
Factor3	1.655	.	17%	53%

Note: LR test: independent vs. saturated: $X^2(45) = 303.82$ Prob > $X^2 = 0.0000$.

Annex 3. Unit root tests.

Variables	Specification	No. of Autoregressive terms	DFA in levels	DFA in the first difference	I(d)
Log (GEPU)	With direction	1	-1.11	-11.87***	1
Log (VIX)	With direction	0	-3.98***		0
Log (IIEB)	With direction	0	-3.46**		0
Log (Y)	With direction and deterministic tendency	0	-2.07	-2.07***	1

Note: Statistical significance level: *** at 1%

Annex 4. SVAR model and specification tests.

Annex 4a. Lag selection number.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-452.865	NA	38.917	15.011	15.691	15.279
1	-363.318	153.510	3.792	12.676	13.901*	13.158*
2	-342.042	33.771*	3.260*	12.509	14.278	13.205
3	-326.005	23.420	3.358	12.508*	14.821	13.417

Note: * indicates lag order selected by the criterion.
LR: sequential modified LR test statistic (each test at 5% level).
FPE: Final prediction error.
AIC: Akaike information criterion.
SC: Schwarz information criterion.
HQ: Hannan–Quinn information criterion.

Annex 4b. SVAR estimate, short-term.

Structural VAR				
Adjusted sample: 2005:T1–2020:T33				
Number of observations: 63				
Model: Ae = Bu where E[uu']=I				
1	0	0	0	
$-a_{11}$	1	0	0	
$-a_{21}$	$-a_{22}$	1	0	
$-a_{31}$	$-a_{32}$	$-a_{33}$	1	
b_{11}				
0	b_{22}	0	0	
0	0	b_{33}	0	
0	0	0	b_{44}	
	Coefficient	St. Error	z-Statistic	Prob.
a_{11}	-0.007***	0.00	-5.40	0.0%
a_{21}	-0.002*	0.00	-1.93	5.4%
a_{31}	0.014**	0.01	-2.00	4.6%
a_{22}	-0.009762	0.11	-0.09	92.7%
a_{32}	-0.813565	0.57	-1.42	15.6%
a_{33}	1.91***	0.68	-2.83	0.5%
b_{11}	23.16***	2.06	-11.22	0.0%
b_{22}	0.234***	0.02	-11.22	0.0%
b_{33}	0.197***	0.02	-11.22	0.0%
b_{44}	1.0629***	0.09	-11.22	0.0%
RV	-365.6313			

Note: Statistical significance levels: *** at 1%; ** at 5% and * at 10%.

Annex 4c. Normality test.

Ho: Normal multivariate residuals				
Sample: 2004:Q1–2020:Q4				
Included observations: 63				
Component	**Asymmetry**	**X^2**	**D.F.**	**Prob.***
1	0.416	1.819	1	0.18
2	0.505	2.680	1	0.10
3	0.234	0.579	1	0.45
4	-0.330	1.144	1	0.28
Joint		6.224	4	0.18
Component	Kurtosis	X^2	D.F.	Prob.
1	2.964	0.003	1	0.95
2	2.878	0.038	1	0.84
3	2.406	0.923	1	0.33
4	3.295	0.228	1	0.63
Joint		1.194	4	0.88
Component	Jarque–Bera	D.F.	Prob.	
1	1.823	2	0.40	
2	2.719	2	0.26	
3	1.503	2	0.47	
4	1.373	2	0.50	
Joint	7.419	8	0.49	

Note: * Approximate p-values are not calculated for estimation.

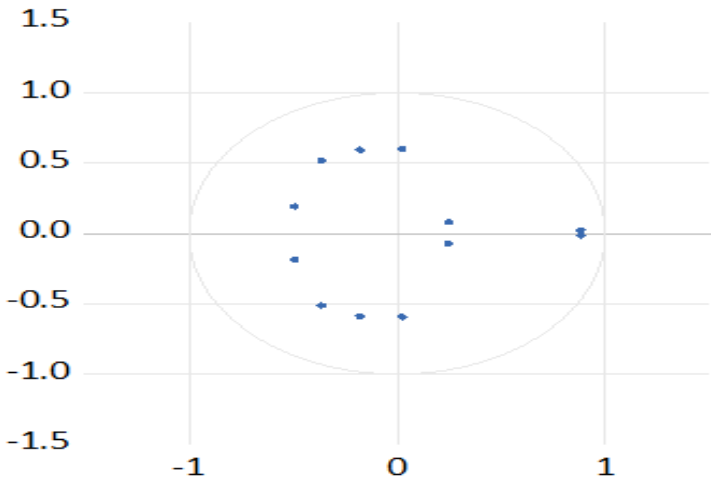
Annex 4d. Non-heteroscedasticity test.

c2	**G.L.**	**Prob.**
257.59	280.00	0.83

Annex 4e. E-Non-autocorrelation test.

Lag	LRE* stat	G.L.	Prob.	Rao F-stat	G.L.	Prob.
1	21.580	16	0.16	1.389	(16, 119.8)	0.16
2	10.740	16	0.82	0.661	(16, 119.8)	0.83
3	18.840	16	0.28	1.199	(16, 119.8)	0.28
4	6.871	16	0.98	0.416	(16, 119.8)	0.98

Note: This is an econometric assumption regarding the non-autocorrelation of the model.



Annex 4f. Model stability test: no inverse roots outside the unit circle are evident.
Note: The multivariate model complies with the stability condition.