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DSO-Design
Statistical Methodology and Production Direction
(DIMPE)

HIGHER EDUCATION COST INDEX GENERAL METHODOLOGY (ICES)

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PRESENTATION

The National Administrative Department of Statistics (DANE), as the coordinating entity of the National Statistical System (NSS), and in the framework of the Statistical Planning and Harmonization project, works toward the strengthening and consolidation of the NSS through the following processes: the production of strategic statistics; the generation, adaptation, adoption and dissemination of standards; the consolidation and harmonization of statistical information and the coordination of instruments, actors, initiatives and products. These actions aim at improving the quality of the strategic statistical information, its availability, timeliness and accessibility to meet the high demand that there is for it.

Aware of the need and obligation of providing users with better products, DANE developed a standard guide for the presentation of methodologies, which contributes to the visualization and understanding of the statistical process. With this instrument, the entity developed the methodological papers of its statistical operations and studies that are made available to specialized users and the public in general. Those papers present in a standard, complete and easy-to-read manner the main characteristics of the technical processes and sub-processes of each study, thus enabling its analysis, control, replicability and evaluation.

This set of papers promotes transparency, trust and credibility of the technical quality of the entity for a better understanding and use of statistical information. Such information is produced under the principles of coherence, comparability, comprehensiveness and quality of statistics.

INTRODUCTION

The Private Higher Education Cost Index (ICESP), for its acronym in Spanish, was established by means of the inter-administrative agreement No 3226 of December 1995. This agreement described as one of its objectives to build an indicator that would serve as a reference to the Colombian Institute for the Promotion of Higher Education (ICFES), the national government, higher education establishments, and the general public for decision-making with respect to readjustments of the tuition fees for the population to have access to higher education.

In order to achieve this purpose, DANE started meetings with institutions interested in the subject, generating the characterization of the costs of private higher education. This work made the design of the ICESP possible, which was released as of the first half of 1998.

After analyzing the results of monitoring the education sector (characterization of costs), in 2010 the need to develop an update to the initial characterization of the cost structure of education as well as the study of the possible inclusion of the public institutions was determined. The figures for the Higher Education Cost Index (ICES) were generated as of the first half of 2014 and after updating the weights and monitoring basket as well as including public institutions.

The ICES allows establishing the semester average variation of a basket of goods and services representative of the cost of the institutions of higher education in the development of their purpose and it allows, among other things, the ability to perform deflation or indexation exercises of the monetary values related to this subject.

In the design of the ICES, DANE applied the experience gathered over the years in the activities of design, production and release of other prices and costs indexes. This specific index incorporates the tools and technology platforms needed to ensure efficacy, efficiency and effectiveness of the results shed by the study.

The technical aspects that allow the generation of figures for the ICES will be presented herein. The following sections describe the background of the study and the peculiarities of the methodological and statistical design, the technical aspects related to the collection process, and the IT tools as well as the dissemination plan. The reader may find the related materials, glossary of basic concepts and appendices at the end of this paper.

1. BACKGROUND

Since 1954, Colombia has been traditional in using the Consumer Price Index (CPI) as a tool that allows calculating the readjustments in the values of different goods and services in the economy, including those related to payments for tuition fees that allow access to higher education. However, for the particular case of higher education institutions, the application of the CPI was questioned given the design features of the index: CPI specifically calculates the average change in the price of the tuition that households undertake in general, as well as the behavior observed for prices of goods and services that are representative of household consumption. (It does not specifically refer to the costs of higher education institutions).

From the analysis above, the ICFES and private higher education institutions raised the need to design a specialized indicator that would determine the evolution of the costs incurred by the institutions, and therefore it will be developed from their cost structure, being understood that a significant proportion thereof would be affected by the salary component; a situation that is completely distant from the structure of expenditures reported by households, where such expenditures are not present.

Accordingly, DANE and ICFES entered into the inter-administrative agreement No. 3226 of December 1995, whose technical purpose was the construction of a specialized indicator, which from the own costs structure of private higher education institutions, would account for its evolution. In developing the agreement, several meetings were carried out with the institutions concerned, so that the cost structure of private higher education was characterized and the design and production of a specialized costs index, which would implement knowledge and experience accumulated by DANE in generating the CPI. The specialized indicator was named the Private Higher Education Costs Index (ICESP).

It is important to point out that the design and production of the ICESP incorporated methodological improvements that allow the optimization of the process and that had previously been implemented by DANE in the updates applied in the CPI. A process of transfer of knowledge and experience was established that was made evident in the production of the indicator as of the first half of 1998.

In 2010, after monitoring the behavior of the costs undertaken by educational institutions, DANE established the need for updating the design of the indicator, particularly in two components: the weights and the selection of the monitoring basket. Similarly, after meetings with external users, the higher education institutions of a public nature were included in the thematic scope.

In the first half of 2014, results for the redesigned index were generated. The indicator includes the institutions of a public nature, hence its name is changed and is now identified as the Higher Education Cost Index (ICES); it is presented with updated weights and selection basket, and it starts the analysis of information in real time by using more efficient technology platforms and the adoption of technical novelties used in other price indexes and costs.

Since its implementation, two designs have been generated for the indicator:

ICES_97

It corresponds to the design that led to the study.

Base period: second half of 1997 = 100

Duration of the design: From the first half of 1998 to the second half of 2013.

Index Coverage

a) Geographic: It is published for the total, collecting information in the following cities: Armenia, Barranquilla, Bucaramanga, Cali, Cartagena, Ibagué, Manizales, Medellín, Pereira, Bogotá and Tunja.

b) Thematic: Information is provided for Higher education institutions of a private nature.

ICES_13

It corresponds to the first redesign generated for the index and it allows implementing the use of technology platforms in the process of collection and analysis of information, as well as the adoption of technical novelties applied in other prices and costs indexes.

Base Period: Base: second half of 2013 = 100

Duration of the design: From the first half of 2014 to date.

Index Coverage

a) Geographic: it is published for the total, collecting information in the following cities: Bogotá, Medellín, Cali, Barranquilla, Bucaramanga, Manizales, Pasto, Pereira, Cúcuta, Montería, Neiva, Cartagena, Villavicencio, Riohacha, Armenia, Quibdó, Sincelejo, Valledupar, Popayán, Ibagué, San Andrés, Santa Marta, Tunja and Florencia.

b) Thematic: information is provided for Higher education institutions of a private and a public nature.

2. DESIGN OF THE STATISTICAL OPERATION

2.1. THEMATIC/METHODOLOGICAL DESIGN

2.1.1. Information needs

The ICES was created as a response to the need for an indicator reflecting the evolution of the costs incurred by higher education institutions, both governmental and private, during the exercise of their duties.

In 2011 and from meetings with external users: the Colombian Institute for the Evaluation of Education (ICFES), for its acronym in Spanish, the Colombian Institute for Educational Credit and Technical Studies Abroad (ICETEX), and the Ministry of National Education, the need was established to include education institutions of a public nature in the thematic scope, in order to provide information on the evolution of the costs for this type of institution, and that can serve as an analysis tool on issues related to the financing of institutions, which given their condition depend on other types of income that are different from payments for tuition.

2.1.2. Objectives

a. General objective

To present, from a base semester, the semi-annual average change in prices of goods and services representative of costs and expenditures made by higher education institutions for the development of their purpose.

b. Specific objectives

- To provide statistical information that allows performing update processes of the monetary flows related to the provision of services made by the higher education institutions.
- To provide information that allows determining real or constant values from nominal data, related to the provision of services generated by higher education institutions.

- To serve as one of the parameters to establish the adjustment of tuition fees and other financing mechanisms of the higher education institutions.

2.1.3. Scope

The research accounts for the evolution of the costs of the higher education institutions, determined as such according to Law 30 of 1992 and identified as: universities, university institutions, technological institutions and technical institutions, of both a public and private nature and located in the Colombian territory.

The following are excluded: institutions dedicated to providing exclusively non-formal education services for work or primary, basic or secondary education, and those whose social purposes determine these services accompanied with the supply of higher education and that do not have accounting information that allows the differentiation of operations. The exclusion is established so as to debug the results, focusing on those generated for institutions specifically supplying higher education.

The scope includes the costs and expenditures executed by the institutions in order to fulfill their purpose, therefore both the expenditures made for purposes exclusively academic, such as the administrative ones and those derived from other activities commonly performed by institutions, such as research are added.

2.1.4. Reference framework

a. Theoretical framework³

Given the information needs established, the type of study to develop is framed as a price index⁴. Conceptually, the construction of an indicator of this type should decide between:

³ The theoretical framework described below is supported on the IMF paper (Cost of Living Index, CPI, fixed-weight index, variable weight index and Fisher index): *Consumer Price Index Manual: Theory and Practice*; 2006.

⁴ In general, an index solves the problem of estimating the aggregate change of prices or quantities of a set of items. Generically, the indicator that allows measuring the evolution of the monetary values is called price index, while the quantities indexes account for the change in volumes. Price indexes (such as CPI) and cost indexes (such as ICES) are included under this name.

Construction of a constant utility index: it seeks to show the change (between two periods of time) of the minimum expenditure needed to purchase a basket of goods and services while maintaining constant the level of utility that the consumer gets. For its development it is necessary to know the level of utility or welfare assumed by the consumer as a unit and as an aggregate. In practice, the construction of these two utility functions is difficult to perform from typical statistical tools (surveys).

In an index of these characteristics, the basket of goods and services should consider all those that are part of the expenditure structure without exception. The above implies that it is not possible to apply selection criteria to the basket from the characteristics of the goods and services, the forms of acquisition or the payment mechanisms.

The demand function therefore depends on prices, quantities and utilities:

$$\text{COLI} = f(\text{Pr}, \text{Q}, \text{Ui})$$

Where:

Pr = prices

Q = quantities

Ui = utility

Given the above, the preparation of a fixed basket index should compare two time periods and consider that utility depends on other variables in addition to prices, such as preferences, social considerations or political changes. (The welfare of agents will depend on the physical and social factors where they evolve, a reality that is not measured within the concept of price).

The construction of a price index (fixed basket indexes): where the implicit utility formed in a preference structure, which remains fixed in the medium term is established. Given the difficulties associated with the construction of a fixed utility index, fixed basket price indexes prove to be an alternative in measuring the evolution of prices and costs.

In the development of a fixed basket index, the problem of constructing an indicator of price evolution is reduced to the measurement of quantities and prices.

The preference structure used corresponds to that observed in the structure of costs and expenditures of agents, for a given period of time (choice can be made between a base and a current period). In fact, Lowe-type indexes, which are defined as "a percentage change in the total cost of acquiring a given set of quantities generally called basket, between the periods compared" are known in the literature.

In the case of consumer price indexes, for example, those goods and services for which the acquisition prices, brands, quality and units for price monitoring can be identified, i.e., end-consumer goods. For the ICES, it would involve linking those goods and services that meet these characteristics and that are included within the proposed thematic scope.

Given the information needs and the difficulty to determine individual and aggregate utility functions, it is frequently performed by means of the construction of a price index. This recurrence refers to the measurement of consumer price indexes according to international practice, as well as the development of specialized indexes in different countries and for various themes, as it is the case for ICES. Price indexes in turn have different alternative calculation that describes methodological variations:

Fixed-weight index (Laspeyres): if two periods of time are considered, a Laspeyres index (theoretical designation of a fixed-weight index) seeks to answer the question: How much does the purchase value of a basket of goods and services increase or decrease, if the purchase quantities of the first period are kept fixed? These fixed quantities relate to the pattern of costs and expenditures for the exercise's base period and, therefore, to the structure of preferences shown by agents. Changes that may occur in the purchase value are assumed as effective price changes.

In the theory of indexes, it is considered that the Laspeyres type may have an upward substitution bias with respect to constant utility indexes because they do not consider the fact that agents may perform replacement processes from the changes that they observe in relative prices or changes in the income level.

Variable weight indexes: a variable weight index or Paasche type for two time periods, seeks to answer the question: how much does the purchase value of a basket of goods and services increase or decrease if the quantity currently bought could be bought while maintaining the prices of the initial period?

In the variable weight indexes, the weighting structure and consequently that of the preferences of agents corresponds to the current period. In this sense it is possible to associate changes in the value of the basket to effective price changes.

In the theory of indexes it is considered that Paasche type indexes may present, contrary to what occurs with the fixed weight indexes, a downward substitution bias as the benchmark for calculating the change is the consumption structure of the current period, and since this structure reflects the price conditions of the current period and not the consumption structure of the previous period, the price changes observed may be lower.

Superlative index or Fisher's ideal price index: the Fisher indexes emerge as an alternative solution to the substitution bias that may arise in the Laspeyres and Paasche type indexes. In this sense they are also an approach to the constant utility indexes. Thus, with a Fisher's ideal price index it is sought to incorporate price changes that are adequately reflected in a Laspeyres index and changes in structure of preferences or patterns of costs and expenditures that are incorporated into a Paasche index. Since the above-mentioned upward and downward substitution bias are solved with a Fisher type index, the latter are also known as superlatives or Fisher's ideal price indexes.

In practice, for the construction of the superlative index, information requirements are greater than the individual case of the other indexes, because prior construction of both Paasche and Laspeyres is necessary.

The ICES develops a Laspeyres-type price index considering that the structure of costs and expenditures of the higher education institutions (henceforth referred to as IES)⁵ is maintained in the short term and to the operational difficulty of biannually updating these structures.

⁵ Acronym in Spanish.

Hence, the ICES is understood as a statistical tool that measures the change in prices of a set of goods and services representative of the costs and expenditures incurred by the IES residing within the national territory, and executed by means of a monetary expenditure.

On the other hand, the ICES is considered to be a cost index because it measures the evolution of costs and expenditures associated with the purchase of goods and services required by the IES for the fulfillment of their purpose. From the foregoing, it is determined that such expenditures are made for the sole purpose of having the items needed for the carrying out of the activities of institutions (costs and expenditures are included in the generic term "costs"); however, it is important to clarify that the thematic scope involves calculating the change in the prices of final purchase to which the IES are subjected in order to have such goods (for example, if the costs for maintenance and repair of technical equipment are included, the methodological construction of the ICES would imply taking into account the final retail prices of such services, including the value-added taxes).

At this point, a differentiation should be made between the concepts of expenditures and costs according to the specification available in the Chart of Accounts (PUC⁶), mandatory nomenclature for natural and legal persons required to keep books, according to the Colombian Commercial Code:

Expenditures: it groups the accounts representing financial and operational charges incurred by the economic entity in the development of the normal course of its activity in a given fiscal term.

Costs: it groups the accounts that represent the accumulation of direct and indirect costs necessary in the development of products and / or provision of services sold, according to the social activity developed by the economic entity, within a specified period.

The ICES owes its name to a cost index in the sense described above, which includes the expenditures and costs referred by the IES.

⁶ Idem.

b. Conceptual framework

Profit and Loss Statement (P&L): also called income statement, it is an instrument of a financial accounting nature, which describes income, costs and expenditures incurred by a natural or legal person during the accounting period (Commercial Code).

Monetary expenditure: it occurs when an agent pays in cash, check, credit card or any other form of financial liability. The scope of the ICES is limited to the expenditures of a monetary nature made by the IES, because they are likely to be observed and recorded (CPI Methodology, 2015).

Laspeyres index: price index defined as of fixed basket or fixed weights, this index uses the basket of goods and services of the base period. The base period refers to both the reference period of weights and the reference period of prices. (International Labour Organization / International Monetary Fund / Organization for Economic Cooperation and Development / Statistical Office of the European Communities / United Nations / International Bank for Reconstruction and Development / World Bank Consumer Price Index Manual: Theory and Practice- ISBN 92-2-113699-X Copyright © 2006 Page 517).

Professional technical institutions: they are characterized by their manifest vocation and identity in the fields of knowledge and work on technical activities, duly based on the nature of a knowledge, whose training should ensure the interaction of the intellectual with the instrumental, the operational and technical knowledge. These institutions may supply and develop training programs up to the professional level, only by propaedeutic cycles and in the areas of engineering, information technology and administration, provided that they derive from the technical professional and technological training programs that they supply, and prior compliance with the requirements set forth in this law⁷.

University institutions or technological schools: the institutions empowered to provide training programs in trades, academic training programs in professions or

⁷ Article 1; Law 749 of 2002.

disciplines and specialization programs are known as university institutions or technical schools⁸.

The differentiation between the university institutions and technological schools is determined from Law 749 of 2002, which defines the technological institutions as follows: "They are Higher education institutions, which are characterized by their manifest vocation and identity in the fields of knowledge and professions of a technological nature, with scientific and research basis. These institutions may provide and develop training programs up to the professional level, only by propaedeutic cycles and in the areas of engineering, information technology and administration, provided that they result from the technological training programs that they supply, and prior compliance with the requirements set forth in this law".

Index number: figure showing changes of a magnitude in time or in space. Important features in the construction of an index number are its coverage, base period, weighting system and method of observations average (Organization for Economic Cooperation and Development [OECD], Data and Metadata Reporting).

Chart of accounts (PUC): it corresponds to a chart of accounts and the description and dynamics for the application thereof, which must be observed in the accounting records of all economic operations or transactions⁹.

To date, its operation is mandatory for all natural and legal persons in Colombia and it allows "... uniformity in the recording of economic operations made by traders in order to enable transparency of accounting information and therefore its clarity, reliability and comparability..."¹⁰.

Change: percentage change calculated for a variable in a given period, in relation to another (Harmonized concepts; DANE, 2015).

⁸ Article 18; Law 30 of 1992.

⁹ Decree 2650 of December 29, 1993.

¹⁰ Article 1; Decree 2650 of December 29, 1993.

Type of institution: for the purposes of the index, the institutions that are included according to the classification defined in Law 30 of 1992 are: Universities, university institutions, technological institutions and technical institutions.

Universities: the entities currently recognized as such and institutions that prove their performance with universality criteria in the following activities: Scientific and technological research; academic training in professions or disciplines and production, development and transmission of knowledge and universal and national culture. These institutions are also entitled to provide training programs in trades, professions or disciplines, specialization, master's, doctorate and post-doctorate programs, in accordance with this Law¹¹.

c. Legal framework

The ICES takes Law 30 of 1992 as a benchmark for construction, which organizes the public service of higher education in the country, particularly Article 16, where the academic nature of the higher education institutions is defined and Law 749 of 2002, whereby the public service of higher education in professional technical and technological training modalities is organized.

Decree 3167 of December 26 of 1968 established as a role of DANE to produce price and cost indexes at the level of the producer, the distributor and the consumer, of main goods and services, to collect and periodically publish a summary of the results; the IES are producing agents of a service.

d. International benchmarks

The construction of indicators concerning higher education focuses primarily on determining the information that measures the efficiency, quality and coverage of the system. Determining the evolution of costs is not a recurring theme in the international benchmarks, although there are exercises of indexes in the US and UK.

The background in the US dates back to 1961, when the HEPI (Higher Education Price Index) was produced by Research Associates of Washington, however, since 2005 the entity designated for the production of the indicator is the Commonfund Institute.

¹¹ Article 19; Law 30 of 1992.

Similarly to what is observed in Colombia, the HEPI describes that most of the costs of higher education are associated with personnel expenditures, whose increases have a differential evolution with respect to the behavior of the CPI (Commonfund Institute, 2007).

In the UK, in turn, the HEPPI (Higher Education Pay and Prices Index) was produced annually until 2011 by the association that groups the university institutions in the country (Universities UK, 2007). The suspension in production was due to changes in the conditions of financing of education institutions, which in turn resulted in the lack of actual users of the indicator.

On the other hand, generically, the international benchmark that supports the design of the ICES is determined by the Consumer Price Index Manual produced by ILO, IMF and OECD, and whose content includes recommendations with respect to methodological additions affecting the calculation of an index, its scope (uses), basic conceptual framework, construction of weights, selection of sources, sample design and price collection (International Monetary Fund, 2006).

e. National benchmarks

Among the national benchmarks of the study is the aforementioned CPI. It is from the setup of two calculation levels in the CPI (fixed and flexible level), that the ICES implements the same type of structure, which allows it to maintain a level of publication for the medium term (fixed level), while constantly updating the goods and services selected for the effective monitoring of the price (flexible level). Likewise, the ICES takes the platform and collection and analysis protocols used in the CPI (Oracle), allowing access to information in real time. Similarly, mechanisms are adopted that allow analyzing and incorporating changes in quality observed in the field (CPI technical novelties).

2.1.5. Design of indicators

The basic information that allowed the construction of weights and the selection of basket in the ICES was obtained by means of the collection of the Profit and Loss Statements (P & L) from the IES. The information collected referred to the costs and

expenditures incurred by all the higher education institutions located in cities covered by the ICES.

Firstly, data collection was developed in 1996 in order to generate the weights of the first design, and in 2011-2012 the exercise was updated in order to generate the corresponding redesign.

The exercise that was performed consisted of requesting the information from the profit and loss statements from the IES for 2010 (collection of information carried out in 2011 and 2012). P & L reflects the movement of income, costs and expenditures, among other information, being the basic accounting support that enabled determining the structure of costs and expenditures. Out of a total of 343 institutions, information of 291 was collected (exercise excluded those IES located outside of the 24 cities covered in the geographic scope of the index, as well as those providing services of formal higher education, and secondary education and / or basic primary at the same time; on the other hand novelties arose associated with the situations presented by certain IES such as the detection of inactivity or temporary closures).

The information collected has the higher education institution as a unit of observation and analysis, since it was not possible for the sources to try dividing their costs and expenditures from their branches. This is the most important reason why the index adds its results to all the cities where the collection was conducted.

The results obtained in the collection of information on costs and expenditures of the ICES are presented below:

Table 1. Coverage obtained according to the nature and type of institution. Construction of weights (%)

Type	Official	Private
University	80,39	92,00
University institution	89,29	86,67
Technological institution	88,89	73,81
Technical Institution	77,78	80,00
TOTAL	83,96	85,23

Source: DANE.

Subsequently, the sources that reported their P & L were requested information with respect to the distribution of expenditures on salaries, between different types of associated profiles. The information collected in the P & L prevented determining for example, the distribution of expenditures among professors: head professors, full time or part time professors; administrative and managerial staff and training expenditures; the types of maintenance performed, or the expenditure on books, supplies and stationery and regular office supplies.

Finally, the results of the exercise provided the costs and expenditures of the IES, data that were indexed (adjusted according to changes in prices more in line with the type of cost or expenditure referenced) to take them to the base second half of 2013. The results allowed calculating the fixed weights used in calculating the ICES as of the first half of 2014 and subsequent (the base period of weights corresponds to the second half of 2013). The weights can be found in the appendices in this document (see Appendix A).

The comparison between the weights of the 97 design (ICESP) and those generated for the ICES_13 design is described below.

Table 2. Comparison of ICESP and ICES weights - total for private institutions

ICES. Comparison of ICESP and ICES weights - total for private institutions										
Description	University	University	University	University	Technological	Technological	Technical	Technical	Total	Total
	Institution	Institution	Institution	Institution	Institution	Institution	Institution	Institution	(ICESP_97)	(ICES_13)
	(ICESP_97)	(ICES_13)	(ICESP_97)	(ICES_13)	(ICESP_97)	(ICES_13)	(ICESP_97)	(ICES_13)	(ICESP_97)	(ICES_13)
PERSONNEL EXPENDITURES	68,69	64,47	63,36	64,62	58,07	71,42	63,99	72,61	66,86	68,58
PURCHASE OF GOODS AND SERVICES	31,31	35,53	36,64	35,38	41,93	28,58	36,01	27,39	33,14	31,42

Source: DANE.

The most noticeable changes occur in the technological and technical institutions, where personnel expenditures have a higher weight in 2013, versus those found in the first design of the index.

The weights present two groups of costs and expenditures; 12 subgroups and 47 classes (three levels of aggregation). From the redesign, 5 new classes are included: cleaning and cafeteria supplies; Internet; mobile telephony; insurance, fees and affiliations.

It is important to note that the ICES includes within its scope the goods and services on which the IES incur in expenditures or costs, items (goods or services) of free access, or those to which it is not possible to assign a price are excluded, as is the case of donations of a religious or charitable nature. Similarly, the payments made by the institution when it is not possible to determine exactly the consideration received in return are excluded, such as payments for income or property taxes.

The ICES excludes payments of interests that can be generated when making a commercial transaction on credit, as well as goods produced for own consumption, since they are non-market transactions, and in all those situations where it is not possible to determine a transaction price associated with a market and that do not involve a buying and selling relationship, as is the case of: barter, gifts, donations in kind and own consumption.

For the specific case of the monitoring to the expenditure in insurance, and taking into account the Manual for the construction of the CPI (IMF; ILO; OECD; UN; World Bank, 2006), the expenditures in insurance that cover constructions and buildings where the IES make a certain payment for: the risk coverage and that related to the recognition for the insurance service are included:

Payment for risk coverage: it is known as the net premium and is considered a transfer of resources, because the payment made by the policyholder, becomes a contribution to a joint account.

Payment for the insurance service: it refers to the part of the policy that recognizes the insurance service provided by the insurance company and its distribution structure. Given that this part of the payment pays a service, it should be considered as the portion to be included within the ICES.

International experience has demonstrated the technical difficulty involved with efficiently determining the difference between the gross premium (understood as the value of the policy = payment for risk coverage + payment for the insurance service), and either of its two components. It would be ideal to have the value of payments for the insurance service exclusively, which is why the ICES estimate the expenditure of the IES in insurance services with the value of the gross premium. Insurance of constructions, buildings, technical and office equipment and transport fleet are currently included.

Buildings and constructions

In reviewing the costs and expenditures, the existence of two situations regarding the ownership of the buildings and constructions where the IES develop their purpose is clear: there are those who have their own buildings, while there are others who agree to enter into a lease; similarly, the existence of various types of constructions and buildings required is made clear: administrative offices; constructions adapted for sports and outdoor activities (swimming pools, gymnasiums, tennis, etc.), laboratories and adequate space for the maintenance of equipment and auditoriums, for example.

It is noted that some types of buildings are leased by both public and private institutions, while others, given their characteristics, are owned by the IES. For this reason and for the IES that report expenditures in the maintenance and repair of their buildings, such expenditures are included within the scope of the index as well as the expenditures that were presented as leasing.

Selection of the basket

The monitoring of prices requires the selection of a representative set of goods and services (monitoring basket), from the application of general and particular criteria on the information of costs and expenditures reported by the IES.

The selection criteria of a general nature that were applied to the goods and services were:

- To have characteristics that facilitates the monitoring of prices and includes the possibility of identifying: a price; determining a base unit; respondent sources as well as the selection of the monitoring specifications that enable identifying the qualities of the items, so that the monitoring of the pure change by price effect is ensured.
- To give sufficient assurance of permanence in the market

On the other hand, particular criteria were implemented in the selection process of the basket, because in order to run the analysis, it was necessary to sort the information according to the nature and type of the institution.

- Participation in expenditure

This criterion defines the goods and services to be included in the monitoring basket; from the participation that each has in different levels or subtotals of expenditure¹² (including the total). International experience encompasses different forms of construction for this criterion: from the historical behavior of the weights, or based on the most updated results of the structure of expenditure and consumption.

The historical analysis of the weights requires the analysis of the results of the source that allows obtaining them applied in different periods, which enables defining the evolution (profit or loss) of the relative weight of each expenditure and from these results to determine the inclusion or exclusion of an item.

On the other hand, and in consideration of the analysis of the results for a given period of time, it is also possible to apply the criteria for inclusion of items from a specific value of participation. This cutoff value is defined depending on the particularities of each country, but in general it is an arbitrary value. The application of this variant also allows determining the cutoff criteria at different levels of aggregation (subtotals of expenditures), determined according to the price variability, for example: a cutoff criteria are established for the inclusion of items considered salaries, and a different one for the rest of the basket. The international recommendation describes, as one of the principles for the construction of the basket, to take into account the

¹² Expenditure is used generically, including both the accounting cost and expenditure.

participation of expenditure within subgroups, but also in lower categories (expenditure class), which ensures the greatest representativeness of the price effect for each level.

In the case of the ICES_13, the cutoff criterion that allows the inclusion in the basket implies that the good or service contains more than 2% of the class and more than 0.01% of the total expenditure.

- Frequency of demand

It is used as a selection criterion so as to determine the forced inclusion of an item. Most statistical systems do not make explicit use of values for performing the analysis of frequency of demand. In the case of the ICES, the frequency of response of the reported cost and expenditure is analyzed. In effect, if an item has a frequency of demand higher than 21% of the IES then it should be included in the basic basket regardless of its relative weight in the expenditure.

- Expectations of growth in demand for an item or product

This specific criterion allows the inclusion of products that appear for the first time in the review of profit and loss statements, have a participation of expenditure and low frequency demand but significant growth expectations in the short and medium term. Their exclusion would lead to a possible and rapid obsolescence of the basket for the monitoring of prices.

Components of the new structure of the ICES

From the revision performed in the CPI_98, DANE advanced in the design of a methodological variant applicable to price indexes of the Laspeyres type, consisting of identifying two general levels in the structure, with differences in their characteristics and manner of updating. These levels are: a fixed level of the structure, accompanied by a flexible level.

Fixed level

It is called that because it is the part of the structure of the indicator that can only be updated from the collection and processing of information from accounting and

administrative records of the IES (profit and loss statements). The above implies that during the term of this review and analysis, associated weights remain stable.

The fixed level is characterized by the fact that it is the part of the structure that will be disseminated and published, and where work continues to be done within the traditional framework of what is described as a Laspeyres type index (each level has an associated fixed expenditure weight, determined from data of the aggregate P & L).

The ICES has three categories, which described from the highest to the lowest level of aggregation are: Cost group, cost subgroup and cost class.

Expenditure group: it is the most general level of the structure, the updated version of the index keeps both cost groups of the ICES: those associated with personnel, and those deriving from the purchase of goods and services.

Expenditure subgroup: it corresponds to the next level of discrimination of results and it includes 12 in total. At this level it is intended to capture the combined price effect, grouping similar categories of items or which might even act as substitutes, grouping functions of use.

Expenditure class: it is the fundamental level of the structure, and it captures a very pure price effect. It also corresponds to the lowest point for which there is fixed weighting. In some cases, it can be the direct equivalent to an item.

Flexible level

It is subject to be modified based on the specialized economic and statistical analysis, which allows detecting changes in consumption patterns reflected in the monitoring of prices.

The above-mentioned flexibility allows the quoting of prices on a wider range of goods and services, thus capturing the heterogeneity of demand among institutions. It also allows greater speed in updating the pattern for the monitoring of prices.

Another advantage of using a flexible structure is the use of the geometric average for the calculation of simple indexes, making explicit the substitution processes that the consumer can make at the level of items or between varieties of items. The use of the geometric average provides mathematical consistency, since when using paired

samples the percentage change between averages of prices is equal to the average of percentage changes.

The flexible level allows capturing the price effect that leads to the appearance of a new item, even if at this level, an associated cost weighting is not available. The addition is applied from the reweighting of the cost, among the items belonging to the expenditure or cost class where the new good or service could be located.

This level in the new ICES may be composed of items or varieties of items, depending on their relative importance in the cost, where cost classes may have the following characteristics:

- **The basic cost class defined as an item in general:** this situation involves the identification between cost classes of items whose importance of cost, frequency of demand and importance widespread in all the IES, make them worth this category, including: internet, air tickets, and electricity. In these cases, the calculation of the price change focuses on capturing varieties of the same product, which may be presenting a substitution in terms of expenditure or complementarity in the same.
- **Cost class defined as an aggregation of goods or services:** this situation involves the identification of some cost items that lack sufficient importance to individually become a basic cost. However, the monitoring of prices of these goods and services is of interest in the short or medium term. Therefore, cost classes are formed from the grouping of goods or services that are homogeneous in their characteristics or behavior of prices.

Monitoring of prices of services of constructions and buildings

The monitoring of prices is performed according to the type of expenditure reported: maintenance and repair of constructions and leasing.

Leasing. It is included within the cost class "Leasing of buildings and constructions" where the cost of leases reported by the IES is represented, and the semi-annual change of the lease of the buildings is collected for which it is possible to locate a source of information.

The procedure for the collection of prices implies enquiring with all the IES included in the sample (it corresponds to all of the IES located in the 24 cities in the country), and where information is collected on wages and salaries, if they have leased some kind of construction or building. If the IES reports that it has, it should complete the information relating to the type of construction, footage and price of the lease.

Maintenance and repair of constructions. For the IES that own their own buildings, the expenditure reported refers to the costs associated with keeping them in proper conditions. Monitoring is performed from the behavior of prices of the inputs typically required for such activities.

The change for the cost class is derived from the results of the ICCV¹³-Housing Construction Cost Index-an indicator published on a monthly basis by DANE and which aims at determining the average change of the cost of housing producers. The change of the maintenance and repair of the constructions in the ICES takes the results published for various levels of generation of results of the ICCV, including concrete, iron and steel and salaries of official staff in charge. (The user interested in identifying the data obtained through the ICCV can refer to them in Appendix B).

It is important to consider that the location of certain buildings, as well as their particular conditions has made it impossible to use another approach in determining the evolution of that cost class. It was not possible to locate, for example, a market transaction (lease), which could be compared to the hypothetical lease that the public IES could make to be located on university campuses in certain cities, under the conditions in which they currently are; similarly, it was not possible to guarantee this type of exercise for private IES located in the downtown section of certain cities, areas precisely characterized by the presence of IES.

¹³ Acronym in Spanish

Calculation methodology of the ICES

Currently, the collection and analysis of information with respect to the ICES is done by means of the same technological platform used by the CPI (Oracle - indexes system). Classification fields of sources are used in the CPI that is not required by the ICES; such is the case of the classification of the type of source and group of sources. For the ICES, all sources should be identified as sources of a commercial type and group of sources 3 (It is not possible to identify an exact socioeconomic strata where the source supplies its products and causes impact with its price policies), except those that are also collected in the CPI because the characterization of the source was already done according to the methodology of the consumer price index.

However, the calculation requires the classification of the information in such a way that it is possible to identify the nature of the IES where information on salaries and leases is collected. The variable that allows determining that information is known as class of sources. Table 3 below identifies classes of sources in the ICES, there are stores and specialty stores, pharmacies, hypermarkets, and differentiated codes that allow establishing, for example, if the source is a private or public university (26 and 22 respectively), university institution, technological institution or a technical institution.

Table 3. Classification of sources

Code of class	Class of source
5	Stores or specialty stores
6	Drugstores, apothecaries or pharmacies and perfumeries
7	Specialized establishments-provision of services
10	Hypermarkets
22	Public_university
23	Public_university institution
24	Public_technological
25	Public_technical
26	Private_university
27	Private_university institution
28	Private_technological
29	Private_technical
30	Stores or specialty stores-large volumes
31	Utilities_public fee
32	Utilities_private fee

Source: DANE.

Calculation inputs

- In group 1 (expenditure on salaries), the collected items are differentiated taking into account the type of institution providing the information, hence the salary of the dean, for example, is differentiated in four codes:
 - Basic salary of the university dean
 - Basic salary of the university institution dean
 - Basic salary of the technological institution dean
 - Basic salary of the technical institution dean

Differentiation ensures that the average change by type of institution is determined based on prices collected in each.

- In the case of public utilities, fees that impact the public and private IES are collected in a differentiated manner, thus a code is used to locate the fees for water utilities for the public IES and another for the private IES.
- As it was mentioned above, the change in prices of maintenance and repair of buildings and constructions is performed from the information published by the ICCV. Similarly, CPI information is used to construct the change of six classes of cost of the ICES (refer to Table 4). The change calculated from the data provided by the ICCV and CPI corresponds to that obtained when comparing May with November of the previous year and November with May, which in any case refers to a semiannual change¹⁴.
- Finally, the calculation requires the collected prices for the rest of the basket (where the specification by type of source affected is not necessary, because it is

¹⁴ The semi-annual change considered in this sense allows making comparable the price change taken from other indexes with respect to the change collected directly by the ICES, which completes the collection of the first half in May, whereas the second semester is completed in November, in order to ensure to be able to publish over half of June and December respectively. It is considered that in any case, the change observed in ICCV and IPC and which should affect the IES should correspond to the months in which they develop activities related to the provision of inputs for carrying out the maintenance and repair and purchases of levels obtained from CPI.

goods and services for which the price is set regardless of whether the prospect client is a particular type of IES or its nature; it is the case of, for example of: books, services for maintenance and repair of equipment, subscriptions to magazines, etc.).

Table 4. CPI items used in the calculation of the ICES

ICES cost class	CPI publication level used
Air tickets	Air tickets
Personal transport	Taxi
Allowance	Meals out of the household
	Inter-municipal bus
Post office charges	Charges for letters and other services
Fuels and lubricants	Fuels
	Change and purchase of oil
Public relations	Aguardiente ¹⁵
	Other alcoholic beverages
	Cigarettes and tobacco

Source: DANE

Calculation

The calculation starts at the flexible level, where all the information collected is located. At this point of the calculation, the information is grouped from the coding assigned to the source according to its class, grouping the data according to the aggregation that they impact, those qualified with a code 5, 6, 7 and 10 affect all institutions. For example, the code 22 implies that the prices collected are aggregated to know the results of the public university.

After performing the grouping of information, the process of generating the calculation is started, which involves the obtaining of relative prices by source, geometric average of simple indexes and their aggregation to determine results by cost classes, subgroups and groups, as obtaining the calculation by type and nature of institution and the total.

¹⁵ A distilled liquor resembling brandy, especially as made in South America from sugar cane.

a. Calculation of simple relative by source: it represents the simple relative value of price behavior for a price by source:

The calculation expression is: $IRS = (P_t / P_{t-1})$

Where:

P_t = price in the current period

P_{t-1} = price in the previous period

The sources of information for the construction of the IRS are the Single Collection Forms (FUR¹⁶) hardcopy and magnetic consolidated in the database.

b. Geometric average of simple indexes: geometric average of simple relative by source for each item previously calculated. The information of the perceived changes in price for the same item in several sources is added at this point.

$$I^{0:t} = \prod \left(\frac{P_i^t}{P_i^0} \right)^{\frac{1}{n}} \quad \text{Where:}$$

p = Price

t = Current period

0 = Previous period

1/n = is the nth root of the quotes that belong to an item

c. Geometric average of the geometric averages of simple indexes: it determines the average behavior of the prices of the items that are part of a cost class, which implies that it allows adding average changes previously calculated.

$$ICC^{0:t} = \prod (I_j)^{\frac{1}{n}}$$

¹⁶ Acronym in Spanish

Where:

l_j = Is the geometric average of the items that are part of the cost class

$1/n$ = Is the nth root of the items that belong to the cost class

d. Cost class Index: At this point the index level is obtained in the simplest fixed level (cost class). The calculation allows chaining the result with the index of the previous period:

$$ICC = ICC_{t-1} * PGG$$

Where :

ICC = Cost class index

PGG = Geometric average of the geometric averages (average of changes of prices for the items that compose a cost class)

e. Cost subgroup Index: This level calculates the weighted arithmetic average of the given indexes for cost subgroup, from the data calculated per class.

$$ISC^{0:t} = \frac{\sum \beta * ICC}{\sum \beta}$$

Where:

ICC = Cost class index

β = Weighting of the cost class

f. Cost group Index: This level calculates the weighted arithmetic average of the given indexes for cost group from the data calculated per subgroup.

$$IGC^{0:t} = \frac{\sum \alpha * ISC}{\sum \alpha}$$

Where:

ISC = Cost subgroup index

α = Weighting of the cost subgroup

g. Index per institution: This level calculates the weighted arithmetic average of the given indexes for the total, from the data calculated per group.

$$IIns^{0:t} = \frac{\sum \omega * IGC}{100}$$

Where:

IGC = Cost group index

ω = Weighting of the cost group

h. Index per type of institution: From the cost group indexes, it is possible to obtain the results for the total according to the type of institution. The indicator generates two qualifications to the type of institution, those determined by the type of institution: university, university institution, technological institution and technical institution (classification called from this point on as "type") and the nature of the institution: private and public (classification called from this point on as "nature"). The calculation by type of institution is obtained from the weighted arithmetic average of the total obtained by institution, according to the type it qualifies into.

$$ITIns^{0:t} = \frac{\sum \omega * IGC}{100}$$

Where:

IGC = Cost group index

ω = Weighting of the cost group

i. Index per nature of institution: Analogously to the previous procedure, it is possible to add indexes per type of institution until reaching the total per nature: public and private.

$$ICIns^{0:t} = \frac{\sum \omega * IGC}{\sum \omega}$$

Where:

IGC = Cost group index

ω = Weighting of the cost group

j. Total index. Finally, and again, with a weighted arithmetic average and from the indexes per nature, the total is obtained:

$$ICES^{0:t} = \sum \mu ITIns$$

Where:

ITIns = Index of the type of institution

μ = Weighting of the type of institution

Special calculations

a. Leases and public utilities

The prices of goods and services, including salaries, are added in a total basket of 24 cities. Exception is made for the items of leasing of buildings and constructions, as well as public utilities (electricity, water, sewerage, cleaning, domestic gas and landline telephony).

There are two reasons determining this situation:

- It was observed that the IES was unable to report the costs and expenditures for leases and utilities disaggregated by branch, so that a weight for these expenditures per city could be constructed.
- On the other hand, it was found that the changes of price for the two types of items are differential according to the city; in terms of leases it begins with the possibility of locating the required buildings and in terms of public utilities, of the policies for determining the fees established by each municipality. In order to demonstrate the relative importance that price changes should have for leases and utilities of the main cities in the country, the weights per city of the CPI were used.

The procedure involved placing the weights of the five main cities of the country (the most heavily weighted in the CPI, which refer to the cities with the highest proportion of household expenditure), and assigning such weight to the changes observed in leases and public utilities¹⁷. Those cities representing more than 75% of the total according to the CPI were selected: Bogotá, Medellín, Cali, Barranquilla and Bucaramanga (cities grouping 77.35% of 100% described in the consumer price index).

For these items, the initial grouping starts in the city where they are collected. The change calculated for each item has a weighting associated to the city so that the total change of the index is calculated from a weighted arithmetic mean.

b. Fees

This class includes the costs incurred by the IES in the negotiation of contracts with legal persons that provide services to it such as legal counsel, technical, accounting and financial advisory and maintenance of computers; but also to contracts entered into with individuals covered by the rules of the Civil Code and the Commercial Code. The most common form of contract are Service Provision Orders (OPS), which define a business relationship and exclude labor relationships, which involve, among others, that the IES is not responsible for the labor benefits and parafiscal charges of their contractors.

¹⁷ Weightings redistributed to reach a total of 100% with the five cities selected.

Again, difficulties arise at this level when trying to determine the costs and expenditures by type of fees, discriminating against those that allow access to services and those that allow the IES to have staff to develop specific tasks, determined according to the purposes of a service provision contract. On the other hand it is observed that the price changes of fees in legal counsel services, technical and accounting advisory differ from those perceived by contractors that are natural persons. In order to address this difficulty, a weight was determined that allows quantifying the weight that the change of fees for services and that of the provision of services should have¹⁸.

The price change of fees for services provided by legal persons is collected with the providers of these services, however, due to the operational difficulty of having the monitoring of prices for contracts with natural persons, and which is a service that allows finding personnel performing specific activities within the IES, it is estimated that its price changes are similar to those observed with personnel on a labor contract, therefore the ICES evolves this item from the change calculated for salaries located in the first group of the index.

Calculation of changes, contributions and participations

From the index number it is possible to obtain the changes, contributions and participations.

Changes: They allow observing the change that the index number had in a time period with respect to another. In the ICES, the semi-annual and annual changes are possible, obtained for any required level of publication (cost class, group and subgroup, type and nature of institution or total).

- Semiannual change = $((\text{Index of period } t / \text{Index of period } t-1) - 1) * 100$

It describes the change of average prices that the level observed has had in the six months elapsed since the last collection of price, for example, the change of the first half, describes the change that the prices have had since December of the previous year and until May of the reference year.

¹⁸ The weighting assigned was determined based on the response to the inquiries that were made on the matter with respect to the most important IES, when an approximate was requested with respect to the composition of that account.

Then the change of the second half describes the cumulative change from May to November of the reference year.

- Annual change = $((\text{Index of period } t / t \text{ Index of period } t-2) - 1) * 100$

It describes the change of average prices that the level observed has had in the last year. It compares the first half of the reference year, with the first half of the previous year; if it is the annual change of the second half, it compares the change of the second half of the reference year, versus the same period of the previous year.

Contribution: It allows measuring the contribution in percentage points of each hierarchical level (cost group, cost subgroup and cost class) to the semi-annual and annual change.

- Semi-annual contribution = $(\text{Total ICES index of the previous semester}) * Pa * VS/100$

Where:

Pa= Weight assigned to the level that needs to be calculated

VS= Current semiannual change, calculated for the level to be calculated

- Annual contribution = $(\text{Total ICES Index for } t-2 \text{ previous semesters}) * Pa * VA/100$

Where:

Pa= Weight assigned to the level that needs to be calculated

VA= Current annual change, calculated for the level to be calculated

Participation: It is the percentage of explanation of the contribution of each expenditure class, expenditure group and expenditure subgroup in the change, of the total index.

- Semiannual participation (PM)

$$PM = (\text{Semiannual contribution of the level} / \text{total semiannual change}) * 100$$

- Annual participation (PA)

$$PA = (\text{Annual contribution of level} / \text{total annual change}) * 100$$

Splicing methodology

In order to provide the users with the necessary tools for them to have the information of ICES adjusted to their needs, the way to perform the splicing of the ICES_13 08 series with the ICESP_97 are presented below.

The splicing procedure, also known as change of base (splice), is obtained by applying a rule of three (3) where the index in base 97 is multiplied by the index published in base 13 /100¹⁹.

Generation of information

The results of the ICES are published biannually by means of the technical bulletin, press release, appendices in Excel and a presentation describing the results.

2.1.6. Design of results

As a result of the ICES, results of the index level, changes, contributions and participations (semi-annual and annual) are obtained. The results for total and according to cost groups, subgroups, and classes generated by type and nature of the institution are included in the output tables (see Appendix C).

¹⁹In any case, the variations are not susceptible to change due to splicing procedures

On the other hand, a technical bulletin is generated on a semiannual basis that describes the overall results of the indicator; a press release with the summary of these results and a presentation, all of which are downloadable from the DANE Website.

2.1.7. Design of the questionnaire

Considering that the design methodology applicable in the ICES has as a main internal benchmark, the design generated for CPI_08 (the design version currently in force), the collection form, validation matrices, analysis and control systems of data are identical to those developed in the consumer price index. The above corresponds to the unification of the processes associated with price and cost indexes that so allow it.

For the collection of the prices of the basket of goods and services of the ICES, the form applicable in the CPI is used: the Unique Collection Form (FUR), implanted in Data Capture Handheld Devices (DMC²⁰) and hardcopy (the use of one or the other substrate depends on field conditions and characteristics of the respondent source).

The design of the FUR is kept in the SatForms application installed in the DMC. The hardcopy form used in the CPI is presented below (Figure 1).

- First module

The DANE logo is included in the module also, and on the hardcopy form, the law of statistical reserve is stated, where respondents are informed with respect to the confidentiality with which DANE information is treated. Furthermore, the page number and total pages to be generated by source are included (page; of)

²⁰ Acronym in Spanish

Figure 1. Single Collection Form

DANE		DEPARTAMENTO ADMINISTRATIVO NACIONAL DE ESTADÍSTICA				Formulario Único de Recolección ICES				PAGINA: DE:		CONFIDENCIAL Los datos que el DANE solicita en este formulario son estrictamente confidenciales y en ningún caso tienen fines fiscales ni pueden utilizarse como prueba judicial.					
2. CIUDAD: AÑO MES		3. FUENTE: GRUPO CLASE		ZONA: SECTOR: MANZANA		NOMBRE: DIRECCION: INFORMANTE: COD. ANTERIOR:		E-MAIL: TELEFONO: FAX:		Artículo Pradiligenciados:							
5. CODIGO	6. NOMBRE - ESPECIFICACIONES				7. Cant. Base	8. Unit. Base	9. Unit. Anterior	10. PRECIO ANTERIOR	11. NT ANT.	12. IN	13. PE	14. SI	15. FC	16. CR	17. Cantidad Recolectada	18. PRECIO ACTUAL	19. OBS.

19. Nombre: _____	Nombre: _____	Nombre: _____
F. Dirección: _____	Dirección: _____	Dirección: _____
C. Teléfono: _____	Teléfono: _____	Teléfono: _____
Fecha de Recolección: DD - MM - AAAA	Fecha de Supervisión: DD - MM - AAAA	FIRMA DEL INFORMANTE

Source DANE

- Second module

In the module, section number two (2-CITY) is included in order to record: In the first space, the city code, according to the Political-Administrative Division (DIVIPOLA) of DANE and in the second space, the name of the city.

In section three (3-SOURCE) is to record the source code, consisting of location sector, section, block and the area where it is assigned, the source group and class (see Table 5):

Table 5. Conformation of the source code

Description of the field	Length	Initial position	Final position
Department code	2	1	2
Municipality code	3	3	5
Sector number	4	6	9
Section number	2	10	11
Block number	2	12	13
Group code	1	14	14
Class code	2	15	16
Source consecutive number	4	17	20
TOTAL	20		

Source: DANE

The second module also includes:

- Name of the establishment
- Address of the establishment
- Telephone number (s) of the establishment
- Name of the respondent
- Previous code (if there was a previous code to identify the source)
- Email
- Fax.

In the second module, section four (4-PERIOD) is included, which corresponds to the identification of the period to which the information corresponds. The year is entered with four digits and the month with two digits.

In order to denote the months, January is named 01; February 02 and so on:

	January	February	March ...	December
Digits:	01	02	03 (...)	12

Finally, a table is included with the information relating to items previously completed by the source, in order to control the quantity of items to collect.

- Form body

Section five (5-CODE) records the item code, which is composed of 8 digits that correspond to the group, subgroup and class where it is classified.

Section six (6-NAME - SPECIFICATIONS), records the item name and description or details of the concepts that make up its specification. Concepts that identify the item and specification are specific to the source, since each establishment sells a brand, a reference, a variety, a model, etc., in particular²¹.

Section seven (7- BASE UNIT) lists the quantity and unit of measure that the system internally has for the item and based on which prices are identified. The system converts the prices to this quantity when the quantity collected (column 15) is different from the base quantity.

Section eight (8-PREVIOUS UNIT) corresponds to the unit of measure and / or quantity taken in the previous collection.

Section nine (9-PREVIOUS PRICE) includes the price obtained (without any conversion) in the previous collection. This price corresponds to the cash price and with the Value-Added Tax (VAT) of the items.

Subsequently, fields 10 to 15 allow establishing whether it was possible to identify the presence of any technical novelty for the reference period, but also including within the field "NT ANT" the assignment of novelties for new products for the item, in the previous period.

Section ten "New Input" (10-I.N.) a cross (X) is recorded when the item is granted the "new input" technical novelty.

²¹ The specifications used also change according to the item collected: the characteristics that allow differentiating a service are different from those that allow defining a good, such as the brand or reference.

Section eleven "Waiting Period" (11-P.E.) a cross (X) is recorded when the item is granted the "waiting period" technical novelty.

Section twelve "Immediate Replacement" (12-S.I.) Is used to point out, by a cross (X), if the immediate replacement of the item specification was made.

Section thirteen, "Complementary Sources" (13-F.C.), is only completed when the information comes from a complementary source, marking a cross (X) and completing the information requested in field 17.

Section fourteen "Reference Change" (14 -C.R.) is completed with a cross (X) when the item is granted the "reference change" technical novelty.

Section 15 "Input Exits" (15 - I.S.) a cross (X) is recorded when the item is granted the "input exits" technical novelty.

Section sixteen "Quantity Collected" (16-UC), records the quantity collected for the item.

Section seventeen "Current Price" (17-CURRENT PRICE) records the price obtained for the item in the current period. This price corresponds to the cash price and with the Value-Added Tax (VAT).

Section eighteen "Observations" (18-OBS) includes the code assigned to each of the pre-established observations. If it is a non-coded observation, on the back of the form or in the field established for this purpose in the DMC, the explanations associated with the novelties that occurred in the collection for the various items are recorded.

Section thirteen, "Complementary Sources" (13- COMPLEMENTARY SOURCES) is used to identify the establishments selected as complementary sources when it was not possible to continue collecting the information for one or more items with the original source. Data of the complementary sources are included in section nineteen, which includes the name, address and telephone number.

The date of collection and supervision should be completed as follows: in the first field, the day with two digits; in the second field, the month with two digits; in the third field, the year with four digits.

The fields to indicate the responsibility of the collector, the supervisor and the respondent should be completed by the relevant person responsible. (In the case of the DMC, the system determines the person responsible from the profile that allowed access to the system and that requires a password for each responsible person). In the collection by means of the hard-copy form, the collector and supervisor should write their name and include their signature, while the signature and / or seal of the respondent is requested. (In the case of collection by means of DMC, this request is discarded and the report of the sources visited by city, area and source will be used instead).

2.1.8. Validation, consistency and imputation standards, specifications or rules

Consistency analysis and basic validation of information is performed by the DMC according to the requirements incorporated in the validation and consistency specifications. Information such as: consecutive number, identification of the city, code and name of the source, collection year and month should be in the format. It is always possible that the fields used to define the technical novelties are not marked (when no situation requiring the creation of a novelty is detected).

Validation specifications describe the name of the variable, field, its description, the value that it can take and observations regarding its completion (See Appendix D).

Imputation processing

Imputation seeks to capture the price effect that the indicator should reflect when the collector faces the temporary absence of an item or variety. The "waiting period" technical novelty identifies those items for which it is impossible to locate price and specifications, and a "period" should be assigned, waiting for such specification (brand, reference) to be back on the market.

Design of processing and imputation methods

The imputation procedure starts with the detection in the field of the temporary absence of the specification (variety) in the source that is being visited. In that case, the "Waiting Period" (PE) technical novelty is recorded in the DMC or the hard-copy Single Collection Form (FUR).

The imputation process is performed with all the information collected for the semester, according to the item and characterization of the source (type / nature) for items of salaries; it starts from the grouping of the sources.

The geometric average of relatives by sources of each item or variety is then calculated, according to the aggregation performed.

$$PGR = \sqrt[N]{Pt / Pt - 1 * \dots * Pt / Pt - 1}$$

Where:

PGR = Geometric average

Pt = Current price

Pt-1 = Previous price

N = Number of quotes collected

Once the result has been obtained, the change is applied to the previous price of the items marked as in waiting period on the understanding that the average market change should be close to the change generated for a specific source, if the item was available to be supplied:

Current price = Previous price * Geometric price

The imputation mechanism does not alter the average change observed of all sources (after incorporating the quotes qualified as Waiting Period), which implies that the execution of the procedure is safe for the purpose of calculating the average change in prices, but it allows keeping the sources / items presenting the temporary disappearance of the specification (brand / reference), collected, given the rules of application of the novelty: it cannot be applied consecutively in collection periods and the total of records qualified with such novelty should not exceed 5% of the total of quotes for a specific item.

2.1.9. Nomenclatures and classifications used

The structure used by the ICES to determine its fixed level (cost group, subgroup and class) and its publication is an adaptation of the PUC and specifically the chapter pertaining to

operating expenses. For the same purposes, in addition to the processing, it uses the classification by type of higher education institution, generated in Law 30 of 1992, which designates: Universities, university institutions, technological institutions and technical institutions.

On the other hand, and for purposes of processing the index, it uses the DIVIPOLA to determine the origin of the information as well as the coding that allows classifying the type of source of information²² (source class).

Similarly, technical novelties are encoded into the base, as follows:

“ “ Reports normally²³.

"CR" = Reference change. It is used when the variety collected presents differences in quality and it is not possible to compare prices.

SI = Immediate Replacement. It is used when the variety collected has small changes with respect to that observed in the previous period, which allows comparing prices.

PE = Waiting period. It is used when there is a temporary absence of the variety in the source.

IS = Input (quote) exits. It is used when the source does not sell the item.

IN = New Input (quote). It is used when an item -specification- is entered.

²² See table in section "Methodology for calculating the ICES"

²³ The price quote collected without novelty does not require marking in the base.

2.2. STATISTICAL DESIGN

2.2.1. Basic components

Universe

It consists of the set of higher education institutions existing in the country and classified in accordance with the provisions of Law 30 of 1992, and commercial establishments where these institutions acquire inputs (goods and services) required for their operation.

Target population

Higher education institutions classified as such according to Law 30 of 1992 and the Ministry of National Education (active institutions under according to the SNIES²⁴) located in the 24 capitals of departments and the establishments located in Bogotá, Medellín, Cali, Barranquilla and Bucaramanga, where these institutions acquire inputs (goods and services) required for their operation.

Table 6. Cities where the IES is collected

Bogotá	Medellín (Metropolitan area)	Cali (Metropolitan area)
Barranquilla (Metropolitan area)	Bucaramanga (Metropolitan area)	Manizales (Metropolitan area)
Pasto	Pereira (Metropolitan area)	Cúcuta (Metropolitan area)
Montería	Neiva	Cartagena
Villavicencio	Riohacha	Armenia
Quibdó	Sincelejo	Valledupar
Popayán	Ibagué	San Andrés
Santa Marta	Tunja	Florencia

Source: DANE-ICES

Statistical framework

In the case of the IES, the census is obtained on a yearly basis, from the SNIES registry under the Ministry of National Education.

²⁴ Acronym in Spanish for National System of Higher Education Information

Definition of variables

The variables used in the statistical operation are classified into:

- Identification variables: It refers to those that allow identifying the sources subject to study and performing their monitoring. These variables comprise:
 - City Code: It corresponds to the code assigned in the DIVIPOLA of DANE
 - Source ID: Single code for sources
 - Item ID: Single code for the items of the basket
- Collection variables: They are those that allow monitoring the prices and varieties of collection. These variables comprise:
 - Price: Price information, reported by the source
 - Unit and quantity collected, reported for the item collected
 - Specifications: Characteristics of items
 - Novelties
 - Field observations

Data Sources

The ICES is a non-probabilistic study. In the collection of items of the basket except those associated with salaries, leases and utilities, the selection of sources is generated from the expert judgment of the logistics personnel present in each of the cities and is verified according to the geo-referenced information.

The criteria for the selection of sources are focused on representing the different places where the IES purchase their goods and services. The selection of sources should meet the following inclusion criteria:

- That such source has a significant influx of institutional buyers, as are the IES, and a sufficient variety of items for sale.
- That it provides real possibilities of permanence in the market, so as to enable regular monitoring of prices.

The indicator has a reference that allows the identification of a possible source for the ICES: each item has a defined minimum quantity that implies that the source to be included should provide such quantity immediately and of a same reference, brand and peculiarities. In this way, it is ensured that the selection of sources discards the suppliers that do not have an actual opportunity to enter the market where the IES purchase. For example, a possible source of detergent should ensure to be immediately able to locate 20 kilograms of the same brand of that item.

The supporting elements for the selection of sources include supplier directories of local Chambers of Commerce, lists of offering parties and specialized directories.

In the case of the price collection of salaries and leases, the ICES collects all the IES located in the 24 cities with geographical coverage (Census); in the same way that all providers of public utilities in the cities are visited (usually less than three).

Geographical coverage

The ICES collects information of salaries (sources are the IES) in 24 capitals of departments, including metropolitan areas for cities that compose them, and that correspond to those regularly visited by the CPI: Bogotá; Medellín with Bello; Envigado and Itagüí; Cali and Yumbo; Barranquilla and Soledad; Bucaramanga and Floridablanca; Piedecuesta and Girón; Manizales and Villa Maria; Pasto; Pereira and Dosquebradas; Cúcuta, Los Patios, El Zulia and Villa del Rosario; Montería; Neiva; Cartagena; Villavicencio; Riohacha; Armenia; Quibdó; Sincelejo; Valledupar; Popayán; Ibagué; San Andrés; Santa Marta; Tunja and Florencia.

In the case of the sources of the rest of the basket, information is collected in establishments located in Bogotá, Medellín, Cali, Barranquilla and Bucaramanga. There is collection in those 5 cities because the suppliers of these items are located in these cities, the IES located outside of these municipalities turn to the supply in larger cities.

There are certain items for which prices are formed in a single city (typically Bogotá), such as cellular telephony. In these cases, the items are marked with the name "national formation", which implies that the collection is conducted exclusively in Bogotá, although the impact of the change in prices radiates to the rest of the country.

Geographical breakdown

The ICES publishes results for the aggregate to 24 cities.

Thematic breakdown

The ICES delivers results for each of the types of institutions (universities, university institutions, technological institutions and technical institutions), discriminated by their nature: public and private; and in turn, according to the level of cost: total, by group, subgroup and class.

2.2.2. Statistical units

Observation unit

Higher education institutions and establishments of wholesale trade, where the IES purchase the goods and services necessary for their operation²⁵.

Analysis unit

It refers to the items included in the monitoring basket of the index, even when the publication requires the aggregation of items in the construction of the first fixed level (cost class).

Sampling unit

Higher education institutions that are authorized by the Ministry of National Education and the establishments engaged in wholesale trade, where institutions acquire inputs (goods and services) necessary for their operation.

²⁵ The name of institution refers to all the institution. The index does not have the branch as a unit.

2.2.3. Reference and collection periods

Reference period

It corresponds to a semester, the first of each year being the lapse located between December and May, whereas the second semester adds the months elapsed between June and November.

The differentiation with respect to what is commonly understood as the first and second half is due to the moments of estimated use of the indicator. At the end of June and December of each year, agents have already made decisions with respect to the costs of the higher education institutions, which is why the publication of the ICES is required before the end of those months.

Collection Period

Data collection is conducted each semester, however the sample is divided so it is collected in some of the months that comprise it, the generality of the basket is collected in March, April and May (first semester), September, October and November (second semester). It is ensured that a third of the sample is taken each month, so that the operation is divided equally, which reduces the impact of such activities. In the case of public utilities, the information is collected every month of the year.

2.2.4. Sample design

Sampling type

For the group of personnel expenditures, the index conducts price collection in the census of higher education institutions located in 24 capitals of department¹⁹. In the case of expenditures of the remaining goods and services (second group) the design corresponds to non-probability sampling.

Definition of the sample size

The sample design for goods and services of the index is not probabilistic. However, a sample size is controlled that allows ensuring a minimum of sources per item given the price change. The process of controlling the sample size is performed annually for the prices of each item with information of source and city.

The specific procedure for each city is as follows:

Step 1. For each item, the geometric average of the change between the price of the current semester and the previous is calculated.

Step 2. With the geometric average, the variance of relative price indexes of items is obtained.

Step 3. The ratio between the square root of the variance and the estimated value of the price (relative error) is calculated.

Given the fact that there is seasonality in the prices of items, the above steps are performed for each semester of the year, obtaining two price relative errors per item.

- a) The record with the maximum relative error for each item is identified.
- b) The information on variance and price relative index is taken from this record.
- c) Finally, the sample size is calculated with the variance and the price relative index, taking into account a sampling error of 5%²⁶.

Accuracy of results

A relative error of 5% is established at the maximum level of disaggregation.

²⁶ CPI Methodology, 2015

Calculation of the precision of results

Sampling errors are calculated through the estimated coefficient of variation, whose formula is:

$$cve = \frac{\sqrt{\hat{V}(\hat{IR}_g)}}{\hat{IR}_g} * 100$$

Where:

$$\hat{V}(\hat{IR}_g);$$

= Estimated variance of the relative of estimated prices

$$\hat{IR}_g$$

= Relative of estimated prices

Management of technical novelties in the observation units

The ICES uses the technical novelties in order to properly capture the different field situations affecting both the price collection and the location of the monitoring specifications associated with the various goods and services. A technical novelty allows facing the disappearance of the source of information, the location of a temporary replacement source and changes in quality (specifications) of a good or service that make it or not comparable.

The redesign implemented in 2014 allowed adopting the same technical novelties established in the CPI:

Waiting period (PE): It is used when an item associated with a set of specifications, is temporarily absent or unavailable. Given its status as temporary, it is not possible to use the novelty two or more consecutive times.

New input (IN): It is used when a new quote (item associated with a given set of specifications) is located. A record marked IN does not enter the calculation in the collection

semester, because it does not have a previous price to locate the relative, however it would be entered as of the next semester.

Immediate replacement (SI): It is used in the price collection when it is possible to locate a good or service with the same features as those that the original quote had. This market situation allows identifying that the qualities of the good or service are the same even if some secondary characteristic was modified. However, this condition makes their prices to be comparable, hence it is a perfect replacement.

Reference change (CR): It is used when the item with the same basic characteristics as the one used for monitoring is intended to be located, but it is not possible to locate a comparable one (the specifications have changed so much that the goods are not comparable). This situation is due to market conditions or technological developments.

Input exits (IS): It is used when the quote (an item associated with a set of specifications) is permanently absent from the source.

Complementary source (FC): It is used when it is possible to temporarily turn to a replacement source that allows locating the information corresponding to a quote, provided that the two sources (the original and the one replacing it), are comparable: belonging to the same source class, under similar conditions of accessibility and similar sizes.

Given the characteristics of each novelty, immediate replacement and complementary source enter the calculation of ICES. The waiting period novelty requires imputation, whereas new inputs, reference changes, and input exits lack the information needed to enter.

2.3. EXECUTION DESIGN

2.3.1. Training system

The training of the personnel engaged for the development of the collection, supervision, analysis and the local and central coordination tasks is deemed to be an essential factor to achieve success in any statistical study and it is part of the continuous improvement process. The training provided to the personnel of the ICES is oriented to the continuous update of human talent, a process based in the socialization of knowledge, the reading of the documents supporting the statistical operation, and the sharing of the experiences achieved throughout the development of the survey. Proper training allows personnel to function in the best way, directly impacting the perception that sources of information have regarding DANE, as the entity in charge of generating statistical information.

The training plan focuses on the use of self-teaching scenarios, working practical exercises as a method to grasp the theoretical knowledge contained in the methodological documents of the index.

The learning process and grasp of knowledge should include, where possible, those techniques that allow interaction of personnel responsible for the activity with the participants, however it is important to establish strategies that allow all of them to be actively involved, preventing more experienced staff from restricting interaction time with respect to the newer staff.

In order to achieve this goal, the following are proposed as activities: to perform dramatizations and presentations by all participants (not exclusively coordinators or those performing such tasks); it is suggested that collectors, supervisors and analysts, develop small presentations not exceeding 20 minutes, where the contents of the sub items listed below are developed, as well as a practical exercise. However, the coordinator staff should be present in such activities, in order to correct and / or verify the contents of the presentation.

List of base concepts to be developed within the training activities:

- Conceptual framework
- Geographic coverage

- Reference Population
- Basket for price monitoring
- Classification of the structure of the basket
- Concept of item or variety
- Item Specifications (brands and qualities)
- Base unit / Collected Unit / Base Quantity / Collected Quantity
- Minimum unit to collect
- Base Price / Price Collected
- Calculation of price changes between two periods
- Geo-referencing and Cartography (sector, section, block)
- Possible classification of sources
- Selection of sources
- Inclusion of new sources / replacement of sources
- Technical novelties definition - application - system process - effect on the index
- Imputation of promotions, offers and discounts
- Frequency of collection
- Definition and conceptualization of "geometric mean"
- Items of national conformation
- Considerations on fieldwork
- Single collection form and its use in the DMC sources (hard-copy FUR)
- Collection system (FUR DMC)

The proper and full completion of this module allows continuing with the following two expenditure groups of the ICES. It is also recommended that once the presentation exercise is completed, all participants discuss at least one case study exercise, which allows laying the theoretical knowledge with the practical reality experienced.

The activities described involve: presentations by the collector personnel; presentations by the supervisor personnel; presentations by the analyst personnel; presentations by the field coordinator or survey assistant personnel; readings, practical exercises - case studies, workshops, dramatizations and debates.

Training exercises should be made taking into account the operating results of each city as well as the comments received from DANE Central. However it is expected that full training is conducted at least once during the year, taking advantage of the contracting process, or if the field personnel with no experience in collection for indexes exceeds 50% of the total.

2.3.2. Preparatory activities

Awareness raising process

The awareness raising is carried out by the collector (and in the accompaniment activities, the supervisor of the area), developed at the time when the sources are visited, informing the respondent about the statistical work of DANE, the objectives of the visit and of the ICES as well as the uses of the index. The purpose of the awareness raising activities is to improve the communication of the field personnel with the source, so that the latter consents to provide the requested information, in the required conditions. At the sources and where possible, the personnel in charge could provide material that allows presenting the ICES, developing the basic information of the study as contents.

Selection of personnel

Once that DANE Central provides the resources and profiles per position to the territorial directorates, the latter seek candidates who meet the requirements and regulations in force for the exercise. These processes are based on verifying and classifying the suitability of persons who apply for each position.

The positions of the ICES operating scheme performed within the territorial directorates that are in charge of the contact with the reporting source and the collection of prices are:

Collector: responsible for collecting the information related to surveys.

Supervisor: responsible for validating the information submitted by collectors.

Analyst: responsible for exercising the control functions over the coverage of the operation and the quality of information.

Once the personnel have been contracted, training is provided to the entire group, using tools such as a video projector, brochures, guides and dramatizations, according to the specifications in the training system section.

On the other hand, persons applying to DANE Central are related to positions in logistics, thematic and IT activities.

Central Logistics: responsible for the analysis, reviewing, correcting and debugging of the quality of information coming from the territorial directorates by checking the data of the national aggregate.

Thematic: responsible for defining and updating the methodological design of the study.

IT Personnel: responsible for providing support, maintenance and development of applications required by the study.

2.3.3. Design of instruments

The instruments for the collection process and data control are listed below:

- Collection manual (completion instructions): It lists the guidelines and the tasks that need to be carried out by the collector
- Supervision manual: It lists the guidelines and the tasks that need to be carried out by the supervisor
- Critique manual: It lists the guidelines and the tasks that need to be carried out by the analyst

- Mobile system user manual: It describes the manual for the proper use of the DMC in the collection
- ICES user manual: It describes the proper use of the application for pre-completion and analysis of data.

2.3.4. Data collection

Operation scheme

The collection of information of the ICES is based on the completion of the FUR. Currently this form is completed with a mixed collection system: hardcopy (according to field situations) and directly on the Data Capture Handheld Device (DMC). Price collection is performed by means of personal visit, it is not possible to collect information over the phone and in no case shall the interview be delegated to another person and / or shall the captured information be disclosed to third parties.

Where necessary, the collection form is made available to respondents, so that they can verify the necessary information to answer the data. A previous visit is made and the instructions for self-completion are delivered. In these cases, the source is requested to complete the information in a sufficient period of days and to deliver it to DANE personnel, who will perform the critique process of information.

The information collected is validated by the supervisor, who on previous request of the analyst and depending on its results, visits the source and validates the information collected within a period not exceeding two days after the visit of the collector was made. The analyst is responsible for analyzing and debugging all information collected.

Working teams are composed in a ratio of three collectors for one supervisor and one analyst. Fieldwork uses a routing that allows distributing the load; such system is generated based on the generation of programming of the information of the month (sources that should be visited in the reference month to collect the items according to their periodicity). From the pre-completion, collectors together with supervisors, review, validate and determine their daily work routes in the collection forms, indicating the sources to be visited; this work should be developed so that the task is equitably distributed during the month.

Daily, the analyst should download the information collected the day before and load the device with the sources to be visited as well as the items that each collector should capture. Thus, he or she controls that the programming is being complied with in accordance with what has been previously established. Collectors and supervisors begin their tasks from the daily programming that is loaded into the DMC, starting the cycle for the day.

Collection is carried out taking into account the frequency assigned to each source, so that each one is visited every semester, but in order to have prices of inputs for each collection month of the index, logistics personnel should ensure that the sample is evenly distributed in 1/3 for each of the months.

Supervision and control of the collection operation

The supervision procedure involves a series of activities aimed at controlling the quality of the information collected, in order to detect atypical situations with reporting sources and special behavior of prices obtained in the collection.

Supervisor activities begin with the delivery of the list of sources to be collected monthly to the collector assigned. In order to verify that this list corresponds to the sources to be visited in the corresponding period, sources are classified by collection area, the list is provided in hardcopy or magnetic media.

Once the information has been collected and according to the report of the analyst and the selection of routes to be supervised daily, the sources are visited so as to establish the veracity of the information, the guidelines outlined by the coordinator and present in the Completion Manual are also applied. The items (codes) supervised should be recorded in the supervision form and the guidelines for their registration should comply with the verification and analysis of information of interest such as the relative representation of the sources, the selective supervision, increases and decreases in price, as well as the application of technical novelties properly supported.

As for the inconsistencies found in the supervision, the corrections are made, relevant observations are included and the information is returned to the analyst. Supervision should address two main aspects: data related to the source and data with respect to items or varieties:

Data of the source

It includes the review and verification in field of:

- Name
- Address and telephone number
- Collection period
- Group and class

In the development of the supervision and according to its results, it is the responsibility of the supervisor in charge to report the novelties to the assigned analyst. In the case of opening a new source, it is essential that the supervisor verifies the characteristics of the IES or establishment of services and trade, so that it meets the inclusion characteristics.

Data of items or varieties

It includes the verification of the quality and completeness of the information for each item (the information associated with each item includes prices, observations and specifications). In general the variables that should be checked are:

- Brand or variety
- Primary characteristics
- Secondary characteristics
- Base unit
- Previous quantity and previous price
- Minimum quantity
- Quantity collected and current price
- Technical novelties, if required
- Observations, if required

The supervisor starts its verification with the data of the source and continues with those referred to items or varieties. Within the supervision of items, it should be verified that the information of items subject to supervision, includes the minimum specifications to identify it, and otherwise to add those that he or she considers necessary to recognize the variety that is being compared between the quoted periods.

Similarly, he or she should perform the calculation of price changes taking into account the quantity collected, the current price and the observations of the collected period with respect to the previous period. Likewise he or she should ensure that the establishment of trade or services immediately supplies the minimum unit required.

In the event that the data provided by the source are inconsistent with respect to those obtained by the collector, it is essential that this situation is reported and to determine whether the respondent (person) is the same or not, if so, the information provided by the source needs to be verified in conjunction with the collector, in order to detect and correct the biases that may arise when querying a different reporting source at each visit (the bias that may occur when querying a different respondent for each person: collector / supervisor or at every visit).

Personnel in charge of the ICES are usually also in charge of fieldwork for other price and cost indexes, because the area responsible for the index also works on the CPI and other specialized indexes and with the relative size of the ICES; thus it is guaranteed to have qualified personnel throughout the year, and with the experience required.

Considering that in the first days of the month, the supervisor does not have supervision work load (the work cycle starts), it is his or her responsibility to agree with and make the accompaniment to each collector, in order to evaluate the whole data collection process, which involves among others, to ensure appropriate interaction with the source, through the introduction, the identification as DANE personnel, verbal expression, interview technique (access to information), survey techniques (to complete or clarify answers) and other skills that ensure the collection and quality of information collected in the field.

As part of the tasks of self-control and continuous improvement, it is the duty of the supervisor and his or her team (analysts and collectors) to locate the necessary space to socialize, and to clarify doubts arising in the processes conducted in field; as well as to discuss the omissions and inconsistencies found. These results need to be recorded on the

supervision form or, if they are subject to conciliation, they are discussed with the entire operation team in order to implement the novelty that better fits, according to the methodology of the ICES.

It is important to note that the supervisor's role is essential, because they are the persons responsible for validating the information collected in the field, using the technical parameters established to ensure control and quality of the process.

The control required by analysis activities lies in the local coordinator and / or professional assistant, who can define, in a random supervision, the number of sources to be supervised taking into account the areas as well as the collector personnel, and registering in a report the programming and the results of the supervision. Semi-annually, the price collection will have a supervision led by the local coordinator and / or professional assistant, for the purpose of verifying situations such as:

- Existence of the reporting source
- Volume and quality of the information collected, verifying the collection date
- Treatment (communication) that the collector gives to the respondent and vice versa
- Other relevant aspects of the collection.

Operating scheme

The data collector will receive from the analyst, the information regarding the working or collection route of the various goods and services. Price collection starts with the selection of the source considering the criteria for developing this procedure; subsequently, the collector should evaluate the specification or variety of the item most sold and collect all of its specifications.

The most commonly used specifications are: the brand of the good; its packaging; the reference; in the case of salaries, the position more recurrently requested and held for a particular level.

The collector constantly checks that such variety continues to be among the bestselling ones at the source; otherwise he or she should locate the bestselling specificity and include

it in the periodic collection, to ensure in this way that the change of price incorporated in the index corresponds to the items with higher demand in the market.

The collection also involves collecting the price of the variety being monitored and the verification of specifications that allow identifying it as well as the collection of field observations required to support the market behavior.

The collector is attentive as to the new sources present in the market and the novelties that the goods and services of the basket may present. It should be noted that he or she should personally visit the respondents and directly obtain the prices of retail sale of goods and services in the sources that so require it. If it is not possible to meet with the respondent, the collector should report this situation to his or her supervisor, who should indicate the procedure to follow in order to agree upon revisits with the source that will allow obtaining the data. In the development of this situation, the DMC locates the "collection pending" status, which allows locating the records that do not have collection yet.

The supervisor assumes direct control over the collection tasks; he or she verifies the information collected in the field. The local analyst and local coordinator define the supervision of the sources and items; they analyze the information added by their collectors and request the revisits. Finally, the local coordinator and / or survey assistant verifies the information in their city and sends the data to DANE Central.

Methods and mechanisms for collection

The collection of the ICES can be started from the first business day of each month of work, ending the penultimate business day. The tool used to perform the fieldwork is the DMC, which allows loading sources and items to collect, entering the information for which the collector is responsible and downloading such information to the database of the study. Sometimes due to field situations, the collection is made on hardcopy forms.

Similarly, the DMC is loaded with information to be supervised that is the responsibility of the person with that profile. Since each collector and supervisor is responsible for areas, these persons can have access to:

- A field to type the password to enter the application of the device.
- Name of the programmed sources.

- Header of the form (general data of the source such as name, code, address, telephone number, area and month to be collected).
- Code of the item, specification, unit and price, technical novelties and observations.

The collection requires the effective control of the process, which is performed among others, from the analysis of the data per source, the coverage achieved and the parameters determined in the indicators of quality and reliability.

Data transmission

The collection and analysis of the ICES is performed on a database management system, which allows real-time access to the information collected in cities by the controls established at the central level. The information collected and analyzed at the different levels flows through statuses, according to the operating process where they may be.

Within the local level the following statuses can be found:

- Pending to be collected
- In collection: Records that are downloaded into the DMC and waiting to be collected.
- Collected: Records that have field information in collection
- Supervised: Records that have supervision information
- For supervision from local: Records that have been designated for supervision
- In supervision: Records that are downloaded into the DMC and waiting to be supervised
- Analyzed local: Records that have the approval of the local analyst
- Local Quality Control: Records that are ready to obtain the approval of the local coordinator or survey assistant. When such review is executed, this information moves to DANE Central jurisdiction, changing to the "Central level to verify" or "Available to central level" status. In this step it is understood that the information transmission is

executed, since the data cannot be updated by the persons with the profiles of the local level

- Central level to verify: Records that are subject to the analysis of the central analysts
- Available for the central level: Records that are in the jurisdiction of the Dane Central logistics team
- To supervise from central: Records marked by the central analysts to be supervised by the cities (a supervision requested from DANE Central)
- Analyzed central: Records that have the approval of the central analyst
- Central quality control: Records ready to obtain the approval of the central coordinator
- Reviewed central: It contains the set of records validated by the logistics team
- Available for calculation: Status of the records that would enter the calculation (have completed all of the information analysis processes).

In the cases where the collection is developed on hardcopy, the entering of information should be made at DANE offices, by means of the DMC.

Coverage control

For purposes of coverage control and ongoing information analysis at the central level, cities provide information on a daily basis depending on the collection programming. There is also a schedule for physical delivery with respect to the forms that require it that way.

Reports obtained through the application allow determining the characterization of records by status (records per items, city and type of source), which allows central and local analysts and coordinators determining the coverage achieved in each status of the information.

On the other hand, the analysis performed in the cities and central level includes the validation of information, verification of the correct application of the technical novelties, the analysis of the average prices, checking of the qualities and specifications of each item (variety), detection of inconsistencies and request of novelties to be supervised.

2.4. IT DESIGN

The collection and analysis of the ICES is performed on a database management system, used for its administration and information management. Among the advantages obtained by the use of the system implemented as of 2014, are the following:

- To have a centralized system, which facilitates control and management
- To locate a single data repository, which prevents the local and central systems from being outdated with respect to each other
- Use of a solid database engine: ORACLE.
- DANE central can perform the monitoring online regarding the progress of the operation in every city, verifying the coverage and quality of information

Main modules

The most relevant functional modules within the IT design for the ICES include: the parameterization section, quality control, collection (covering the analysis component), calculation module, report generation and options associated with the user.

Parameterization section: It allows the designated user, to include the persons determined in the profiles: collector, supervisor, local analyst, local coordinator, central analyst, central coordinator and technical secretary. The determination of the cities where collection and the monitoring basket (items) are performed, designating the characteristics associated to it, such as: monitoring specifications applicable to each and units of measure, among others. Also, this module allows designating the sources, opening an operating period (each beginning of the month) and determining how it impacts the price collection for those items designated as being "national formation".

Quality control: This module allows locating the quality indicators and designated workloads.

Collection: This module allows programming the local collection, performing the analysis of information and programming the supervision. In the analysis section, it is possible to review the information from indicators such as: the average of prices and changes, minimum and maximum value analyzed; average changes calculated per item, city and income level and distribution of records: collected and pending to be collected, among others.

Calculation: Module under development. The calculation of the ICES is developed through Microsoft Excel®.

Reports: This module allows the generation of reports for the control of the operation, including the collection process and programming, and supervision, among others.

User: This module allows updating the user password.

Each of the modules has a restricted access according to the profile assigned by user, for example, officials at the local level, have access to the information in their city and area (s) assigned, whereas the central level has more permissions to access data.

Databases

The information collected and analyzed is located in a single centralized database, allowing a real-time verification. The collected data are digitalized by means of the DMC, and are entered into the ICES database under the "collected" status; as the review is conducted in each city and central level, records change their status, being subject to such review processes.

The authorizations for editing the information are established from the process executed; if the verification of the information is undertaken by the city, persons with local profiles are able to modify the information; on the other hand, if the central level undertakes the analysis, the associated profiles are authorized to edit information. However, the system saves each of the changes made, date of change and the user profile that executed the process. Admission to the platform is only allowed through the determination of a user and password controlled by the central level.

Anonymization

The anonymization of the ICES database requires the establishment of a protocol that ensures the statistical reserve of the reporting sources. This protocol is under review.

Information collected by the ICES is under statistical reserve, which means that its publication can only be performed when data is aggregated, so that it is not possible to determine the specific reporting source.

2.5. DESIGN OF QUALITY CONTROL METHODS AND MECHANISMS

Statistical production is developed in two levels: local and central. The local level includes each of the six regional directorates of DANE that the entity has to carry out the processes established in the functional model. These directorates include the information of the twenty-four cities selected in the country. Moreover the central level or DANE Central refers to statistical production processes that take place at the entity's headquarters in Bogotá.

Each of the levels is in charge of quality control taking into account their particular competence. Control tools are described in the system manual and of each profile involved: collector, supervisor, analyst and coordinator, and generally refer to the verification of changes in price and coverage.

At the local level, each branch and sub-branch of DANE should organize, prepare, collect, perform, supervise and capture the information related to the study. Each Territorial Directorate is responsible for the statistical quality generated with respect to the monthly collection and analysis procedures; this is why it should require an accurate and effective fulfillment at different stages to the personnel responsible for coordinating and monitoring such process.

At the central level, the functional structure has a technical coordinator and a technical secretary, responsible for the technical and methodological aspects, a coordinator of the logistics team, with an assistant for the study, and professionals who are responsible for analyzing, validating, debugging, correcting and giving consistency to the information reported by each of the cities that make up the geographical coverage of the study.

At the territorial level, the functional structure has an operation coordinator, an indexes coordinator, an assistant for the study, analysts, supervisors and collectors, according to the number of quotes of the items that are monitored in each city. Operation coordination is responsible for the study within the Territorial Directorate.

The indexes coordinator is responsible for the operational process and its proper functioning, whereas the technical assistant is responsible for accompanying the coordinator in all the coordination tasks, instruction, training, monitoring of the tasks assigned by DANE Central or the indexes coordinator.

The analyst is responsible to analyze and debug all collected information, so it is of high quality when sending it to DANE Central according to the schedule established. Supervisors are responsible for validating the information collected in the field and make the necessary changes so that the information is reliable and of quality.

Collectors are responsible for visiting all the sources that are part of the study sample; they collect the information and, in turn, develop the awareness raising process with each of the respondents.

Analysis of information

The analysis is described below when the process of the ICES starts, i.e. at the level of prices per variety - items or microdata, task carried out by the field logistics. The analysis of information starts when records are in the status of competence of the central or local analyst; this task should be carried out throughout the whole month, so that the continuity of the process for all records is ensured, avoiding the accumulation in the analysis any time of the month.

In order to run the analysis of information of the ICES, there is an analysis module -section-, whose main objective is to allow the evaluation of the consistency of the information collected in each city, in order to detect errors and correct prices or novelties assigned.

This process takes into account the assessment of data registered for the reference period of each of the items making up the basket, a process that makes it necessary to perform various types of analysis to give validity and final consistency to the data collected. The basic coherence analysis of information is performed by means of:

The horizontal analysis of data: It enables evaluating the historical records of prices and technical novelties applied in previous periods; it is verified that the specifications of each item conform to the parameters established in the study manuals. Similarly, previous and current absolute prices are analyzed, it is verified that the previous and current collected quantity relates or is equivalent with the base unit and quantity indicated for each item (unit and quantity of measurement), the changes recorded are analyzed and the observations recorded by collectors and supervisors are validated. This analysis also involves the verification of collection specifications, which allow establishing whether the price change is associated or not with a possible change in the quality of the variety collected. This exercise allows having sufficient information that enables the analyst to make decisions regarding the behavior of price changes.

The vertical analysis of data: It allows evaluating the prices and minimum and maximum changes, an analysis is made of the behavior of prices and changes at the local and national levels, and the prices and the previous and current average changes are evaluated.

The analysis of auxiliary tables: Central and local analysts use the information presented in the auxiliary tables generated by the system in order to complete the information required for decision-making with respect to the records they are responsible for.

The auxiliary tables include: Reference tables for prices and changes, which calculate prices and changes: maximum, average and minimum for the month, year-to-date and twelve months of the reference month and city requested; table of prices and minimum, maximum and average changes, which calculate prices and changes of the effective records of the month; summary table of quotes and technical novelties, which allows determining the total of quotes that should be available at the end of the processing month, the quotes collected and the technical novelties applied as well as the table of geometric average by income level (for ICES the "level income" variable is safe, which means that it can be analyzed from source group, 1, 2 or 3) that displays the result of the geometric averages by city, for each item and income level.

The news context: All local and central profiles take into account the market behavior broadcasted through the media such as news, newspapers, magazines and Internet queries, so that they have all the mechanisms to make appropriate decisions based on the objectives and scope of the ICES. In the cities, local media news are taken into account. Within the analysis of the behavior for the items included in the group of salaries, reports

that are available on increases in minimum wages and the various resolutions that support the changes for public entities and the data published by different media are used. The analysis that can be performed from sources of information other than the collection itself made by the ICES, considers the methodological differences of these results, but allows identifying trends in behavior of prices, complementing the task.

Changes in tuition fees for higher education (CPI): In the case of the thematic team, an analysis parameter of the results obtained is found in the results of the average change with respect to higher education tuition fees of the CPI.

Analysis of results: Immediately after the calculation, the technical secretary (directly responsible for the calculation of the index) and the thematic coordinator, check and analyze the results obtained. The task involves the analysis of the most important contributions by level of publication and historical changes as well as the comparison of the results with respect to context analysis previously established to determine the coherence of results.

Quality indicators

The analysis of the production process of the ICES includes the generation of quality indicators, a tool calculated from the territorial level and which concludes with the analysis of the tasks of the central level.

The reliability indicator consists of indicators describing the coverage of sources and records, as well as the proportion of records imputed from the local and central levels:

Coverage indicator

It allows measuring the collection task, by quantifying the coverage achieved. There are:

Coverage of sources

$$\text{ITRF} = \text{TRF} = (\text{FV} / \text{FE}) * 100$$

Where:

TRF = Response rate per Sources

FV = Sources visited

FE = Sources expected

Coverage of records

$TRR = (\text{Effective Records} / \text{Expected Records}) * 100$

Where:

Effective Records = Records without the application of Technical Novelties

Expected Records = Number of pre-completed items for collection

Quality Indicator

It allows quantifying the quality achieved in the process of analyzing the index. There are:

Indicator of no imputation

It corresponds to the difference between the total number of records and the number of those marked with a technical novelty.

Index of no local imputation or estimation (INIL)

$INIL = (\text{RES} - \text{Records marked with novelty} / \text{RES}) * 100$

RES = Records expected

Index of no central imputation (INIC)

$INIC = (\text{RES} - \text{Records marked with novelty in DANE Central} / \text{RES}) * 100$

Reliability index (ICFA)

The reliability indicator is established from calculations already made and that measure the coverage and quality at different stages in the process; it is calculated as:

$ICFA = (\text{ITRF} + \text{ITRR} + \text{INIL} + \text{INIC}) / 4$

ICFA = Reliability Indicator

TRF = Response rate per Sources

TRR = Response rate per Record

INIL = Index of No Local Imputation

INIC = Index of No Central Imputation

2.6. PILOT TESTS DESIGN

Since the study is regular, the pilot tests design is usually performed when significant changes are made to the design. Given the redesign work developed in September and October 2013, it was necessary to incorporate tests for verifying the items selected in the initial basket, and that did not coincide with those collected in previous semesters, verifying the behavior of the new capture and analysis system. From the redesign, the study goes from FOX to use the Oracle platform.

With respect to the tests of information collection, an awareness raising exercise was performed with the sources and location of new items from March 2013 until August of the same year. The results allowed collecting prices of goods and services. The test was developed using the same form previously described.

Regarding the application, the test thereof was performed during the same period, months in which the corresponding accessibility and functionality tests were made. The test was developed on a server enabled for that purpose, noting that in general the system behaved properly with respect to the storage and handling of information. Once the testing phase was complete, the results allowed using ORACLE in the collection and regular analysis of the index as of the second half of 2013.

2.7. DESIGN OF ANALYSIS OF RESULTS

2.7.1. Statistical analysis

Descriptive analysis of data in the ICES focuses on the validation of changes in prices of items in the reference basket (Pt) between time periods and of semiannual frequency, in order to identify the pure change in price that does not depend on changes in the quality of the variety collected.

Such validation includes the analysis of available information in order to identify potential errors and determine the economic support required by any atypical behavior.

The analysis is performed in two steps of the operating process. The first takes place at the local level, and includes the horizontal and vertical analysis of data and the comparison with news context concerning the city; whereas the second is performed centrally and aims to verify the information of the national aggregate.

2.7.2. Context analysis

Changes of the ICES are compared with the results of other DANE studies covering the thematic related to the measurement, such as the results of price changes in higher education tuition fees of the CPI. The aim of the exercise is to compare the results and identify specific situations that require the methodological or logistics review of the studies included.

On the other hand, the historical coherence of results is established when reviewing the historical changes. All these tools allow the thematic analysis of price evolutions (increases and decreases) Finally, the news context regarding the behavior of the various economic sectors and which was issued by media as news, newspapers, magazines, and Internet queries are taken into account.

2.7.3. Committees of experts

Preceding the publication, the officials responsible for the indicator hold an internal technical committee meeting, which allows having a scenario of exchange between methodologists in charge of the various studies of DANE and that are directly related to the

ICES. The committee aims to discuss the realities perceived from other standpoints and to provide feedback to the studies.

Similarly, an external committee meeting is held where specialized users of the ICES take part, and where the results obtained are socialized and contextualized. It is a scenario for interaction between officials in charge of the index and its users.

2.8. DESIGN OF DISSEMINATION

The indicators subject to dissemination correspond to: index number, changes, contributions and participations, of a semiannual and annual nature. The information is published through the DANE Website and is generated on the second half of the months of June and December.

2.8.1. Data repository management

The consolidated database is maintained in an exclusive server for Indexes at the headquarters of DANE Central. From this database, queries are generated to make the calculation and subsequent dissemination. The technical secretary of the study manages the application for the handling of this database.

2.8.2. Dissemination products and tools

The following documents are produced from the semiannual calculation:

Technical Bulletin It contains the results of the indicator: changes and semiannual and annual contributions to the total, by type and nature of the institution, per cost groups, subgroups and classes.

Press release: It corresponds to the summary of the technical bulletin.

Appendices: Excel document that presents the results obtained (index number, changes, semiannual and annual contributions and participations, for total, by type and nature of the institution, per cost groups, subgroups and classes).

Methodological documentation: The public has access to this methodological document and the summary datasheet thereof (methodological datasheet).

All the information is available on the DANE Website, and the corresponding update dates are reported through the entity's official release calendar.

2.9. DESIGN OF THE EVALUATION

To meet the quality standards is essential in the production process of statistics; in this sense the design of the evaluation in the ICES study becomes an important mechanism to give a proper treatment to this information.

The evaluation made to the index study is a process that is continuously performed, in several stages from the design to the production and dissemination process thereof. It includes among other things:

Certification with international experts: It consists of regular visits with experts from various international organizations responsible for evaluating the entire process associated with the index: IT component, calculation and capture application (application matrices), component of design of the sample, results and dissemination and finally the approach to external and internal users.

Customer satisfaction survey: It is a tool to know the needs of customers and is worked in conjunction with the Data Bank of the entity, which is the first channel of contact with users.

Internal and external committees: It corresponds to monthly meetings, which are carried out in order to analyze the results of the study in a context of the economic situation and they allow informing the users about the results of the ICES, in an explicit and confidential manner. These two committee meetings are held after the publication of the results and allow receiving suggestions and recommendations of users and advisors.

3. RELATED MATERIALS

The ICES documentation is located on the DANE Website (<http://www.dane.gov.co/index.php/indexes-de-precios-y-costos/indice-de-costos-de-la-educacion-superior-ices>) and it comprises:

- Thematic design methodology
(http://www.dane.gov.co/files/investigaciones/fichas/Metodologia_ICESP_13.pdf)\
Methodological datasheet.
- (http://www.dane.gov.co/files/investigaciones/fichas/_ICESP_13.pd)

GLOSSARY²⁷

Base Unit: Measurement unit to which the observed price is converted when the equivalence of that price does not correspond to this unit. This conversion of the price is required, as prices only can be compared when they are expressed in the same unit of weight, volume or quantity (units). The base unit matches the minimum unit that can be marketed with respect to an item.

Complementary Source: It is thought as an alternative to replace the absence of a specification in a source to which a perfect replacement cannot be applied or it is not possible to apply a change of reference, seeking a specification of the same quality in another establishment, without any change in the characteristics of the item. No novelty of a technical nature applies to this source. If the specification does not show again in the original establishment, a new specification should be taken in it. If this is not possible, it needs to be taken at another source or include the specification in another original source, where it is not quoted.

Data Capture Handheld Device (DMC): Mobile technological tool that has been implemented in the CPI study in order to capture information directly on the field of all goods and services that make up the basic basket.

Elemental aggregate: Is a set of goods relatively homogeneous both in their physical characteristics and behavior of changes in prices.

Fees: Prices of goods or services which are established by a very limited number of producers or distributors. Producers or distributors may influence consumer habits by fixing the fees in the market segment, according to the characteristics of consumers, for example, those occurring with respect to public utilities.

Immediate replacement: It is established to address the absence of a specification by replacing it with a "perfect replacement" considering all quality characteristics, and using as an approach to this concept the price, quantity and brand. The effect on the calculation

²⁷ Source: <http://sen.dane.gov.co:8080/senApp/module/conceptosModule/index.html>;
CPI_98 Methodology; CPI_60 Methodology

system is changes in minimum ranges that the consumer can receive when making their consumption expenditure and move in its structure of preferences.

Reference change: Novelty that allows facing the change of quality of a specification. The absence may occur due to market conditions or changes in the primary characteristics of a specification, these being understood as those that differentiate one product from another, or even between varieties thereof. The reference change is a procedure that allows "capturing" quality changes in the items in an implicit manner.

Single Collection Form (FUR): It corresponds to the design of the collection form with which work is performed on forms (printed sheets) or PDA (magnetic form). This format is designed per sources, which may contain simultaneous information of one or more items of different brands, varieties or specifications.

Sources: They refer to the commercial, municipal or educational establishments selling one or more items, or provide a service to the final consumer.

Waiting period without information: Collection period without information for any item or good, because the brand or variety subject to price monitoring cannot be found, and is used when the lack of information is of temporary nature.

BIBLIOGRAPHY²⁸

- Common fund Institute. (2007). HEPI Question & Answers. Wilton: Common fund Institute.
- DANE. (2012). Metodología del Índice de Costos de la Educación Superior Privada (*Private Higher Education Cost Index Methodology*) – ICESP.
- ____ (2015) Metodología del Índice de Precios al Consumidor - IPC (*Consumer Price Index Methodology - CPI*)
- ILO, IMF, WB. Consumer Price Index Manual. Theory and Practice. 2006
- Law 30 of 1992.
- Law 749 of 2002
- LEGIS (1997). Plan Único de Cuentas (PUC) (*Charter of Accounts*). Legis Editores. Quinta ed. Bogotá.
- Universities UK. (2007). Higher Education Pay and Prices. London: Universities UK.

²⁸ The translation of bibliographic titles is for reference purposes only.

APPENDICES

APPENDIX A. Weights

Weight by nature of the institution

Code	Nature	Weight
19	PUBLIC INSTITUTION	44,61
29	PRIVATE INSTITUTION	55,39

Weight by type of institution

ICES. Weight by type		
Code	Type of institution	Weight
91	UNIVERSITY	74,17
92	UNIVERSITY INSTITUTION	13,67
93	TECHNOLOGICAL INSTITUTION	10,52
94	TECHNICAL INSTITUTION	1,64

Weight by nature and type of institution

ICES. Weight by nature and type

Code	Nature	Type	Weight
11	Public	UNIVERSITY	31,23
12	Public	UNIVERSITY INSTITUTION	3,72
13	Public	TECHNOLOGICAL INSTITUTION	9,
14	Public	TECHNICAL INSTITUTION	0,26
21	Private	UNIVERSITY	42,93
22	Private	UNIVERSITY INSTITUTION	9,95
23	Private	TECHNOLOGICAL INSTITUTION	1,13
24	Private	TECHNICAL INSTITUTION	1,38

Source: DANE. EDID thematic expert.

Weights by groups and according to nature and type of institution

ICES. Weights by cost groups according to nature and type of institution			
Code	Institution	Group	Weight
1110	Public_university	PERSONNEL EXPENDITURES	22,73
1120	Public_university	PURCHASE OF GOODS AND SERVICES	8,50
1210	Public_university institution	PERSONNEL EXPENDITURES	2,82
1220	Public_university institution	PURCHASE OF GOODS AND SERVICES	0,90
1310	Public_technological	PERSONNEL EXPENDITURES	6,91
1320	Public_technological	PURCHASE OF GOODS AND SERVICES	2,49
1410	Public_technical	PERSONNEL EXPENDITURES	0,21
1420	Public_technical	PURCHASE OF GOODS AND SERVICES	0,05
2110	Private_university	PERSONNEL EXPENDITURES	27,68
2120	Private_university	PURCHASE OF GOODS AND SERVICES	15,25
2210	Private_university institution	PERSONNEL EXPENDITURES	6,43
2220	Private_university institution	PURCHASE OF GOODS AND SERVICES	3,52
2310	Private_technological	PERSONNEL EXPENDITURES	0,80
2320	Private_technological	PURCHASE OF GOODS AND SERVICES	0,32
2410	Private_technical	PERSONNEL EXPENDITURES	1,00
2420	Private_technical	PURCHASE OF GOODS AND SERVICES	0,38

Weights by subgroups and according to nature and type of institution

Code	Institution	Subgroup	Weight
211001	Private_university	NON-TEACHING PERSONNEL	9,74
211002	Private_university	TEACHING PERSONNEL	17,94
212001	Private_university	MAINTENANCE AND REPAIRS	1,30
212002	Private_university	SURVEILLANCE SERVICE	0,85
212003	Private_university	CLEANING, CAFETERIA AND RESTAURANT SERVICE	0,81
212004	Private_university	ALLOWANCES, TRANSPORT AND COMMUNICATIONS	1,85
212005	Private_university	LEASES	0,48
212006	Private_university	PUBLIC UTILITIES	1,02
212007	Private_university	STATIONERY AND SUPPLIES	1,13
212008	Private_university	OTHER INSTITUTIONAL EXPENDITURES	2,22
212009	Private_university	PURCHASE OF EQUIPMENT AND SOFTWARE	1,31
212010	Private_university	COMMISSIONS, FEES AND PROFESSIONAL SERVICES	4,28
221001	Private_university institution	NON-TEACHING PERSONNEL	2,52
221002	Private_university institution	TEACHING PERSONNEL	3,92
222001	Private_university institution	MAINTENANCE AND REPAIRS	0,23
222002	Private_university institution	SURVEILLANCE SERVICE	0,10
222003	Private_university institution	CLEANING, CAFETERIA AND RESTAURANT SERVICE	0,07
222004	Private_university institution	ALLOWANCES, TRANSPORT AND COMMUNICATIONS	0,42
222005	Private_university institution	LEASES	0,27
222006	Private_university institution	PUBLIC UTILITIES	0,38
222007	Private_university institution	STATIONERY AND SUPPLIES	0,31
222008	Private_university institution	OTHER INSTITUTIONAL EXPENDITURES	0,49
222009	Private_university institution	PURCHASE OF EQUIPMENT AND SOFTWARE	0,24
222010	Private_university institution	COMMISSIONS, FEES AND PROFESSIONAL SERVICES	1,00
231001	Private_technological	NON-TEACHING PERSONNEL	0,40
231002	Private_technological	TEACHING PERSONNEL	0,41
232001	Private_technological	MAINTENANCE AND REPAIRS	0,02

232002	Private_technological	SURVEILLANCE SERVICE	0,01
232003	Private_technological	CLEANING, CAFETERIA AND RESTAURANT SERVICE	0,01
232004	Private_technological	ALLOWANCES, TRANSPORT AND COMMUNICATIONS	0,03
232005	Private_technological	LEASES	0,04
232006	Private_technological	PUBLIC UTILITIES	0,03
232007	Private_technological	STATIONERY AND SUPPLIES	0,03
232008	Private_technological	OTHER INSTITUTIONAL EXPENDITURES	0,04
232009	Private_technological	PURCHASE OF EQUIPMENT AND SOFTWARE	0,01
232010	Private_technological	COMMISSIONS, FEES AND PROFESSIONAL SERVICES	0,10
241001	Private_technical	NON-TEACHING PERSONNEL	0,50
241002	Private_technical	TEACHING PERSONNEL	0,51
242001	Private_technical	MAINTENANCE AND REPAIRS	0,04
242002	Private_technical	SURVEILLANCE SERVICE	0,02
242003	Private_technical	CLEANING, CAFETERIA AND RESTAURANT SERVICE	0,02
242004	Private_technical	ALLOWANCES, TRANSPORT AND COMMUNICATIONS	0,03
242005	Private_technical	LEASES	0,05
242006	Private_technical	PUBLIC UTILITIES	0,04
242007	Private_technical	STATIONERY AND SUPPLIES	0,03
242008	Private_technical	OTHER INSTITUTIONAL EXPENDITURES	0,07
242009	Private_technical	PURCHASE OF EQUIPMENT AND SOFTWARE	0,02
242010	Private_technical	COMMISSIONS, FEES AND PROFESSIONAL SERVICES	0,08

Code	Institution	Subgroup	Weight
111001	Public_university	NON-TEACHING PERSONNEL	6,71
111002	Public_university	TEACHING PERSONNEL	16,02
112001	Public_university	MAINTENANCE AND REPAIRS	0,30
112002	Public_university	SURVEILLANCE SERVICE	0,65
112003	Public_university	CLEANING, CAFETERIA AND RESTAURANT SERVICE	0,47
112004	Public_university	ALLOWANCES, TRANSPORT AND COMMUNICATIONS	0,87
112005	Public_university	LEASES	0,18
112006	Public_university	PUBLIC UTILITIES	0,72
112007	Public_university	STATIONERY AND SUPPLIES	0,82
112008	Public_university	OTHER INSTITUTIONAL EXPENDITURES	1,11
112009	Public_university	PURCHASE OF EQUIPMENT AND SOFTWARE	0,35
112010	Public_university	COMMISSIONS, FEES AND PROFESSIONAL SERVICES	3,05
121001	Public_university institution	NON-TEACHING PERSONNEL	1,22
121002	Public_university institution	TEACHING PERSONNEL	1,59
122001	Public_university institution	MAINTENANCE AND REPAIRS	0,09
122002	Public_university institution	SURVEILLANCE SERVICE	0,03
122003	Public_university institution	CLEANING, CAFETERIA AND RESTAURANT SERVICE	0,08
122004	Public_university institution	ALLOWANCES, TRANSPORT AND COMMUNICATIONS	0,09
122005	Public_university institution	LEASES	0,01
122006	Public_university institution	PUBLIC UTILITIES	0,05
122007	Public_university institution	STATIONERY AND SUPPLIES	0,14
122008	Public_university institution	OTHER INSTITUTIONAL EXPENDITURES	0,12
122009	Public_university institution	PURCHASE OF EQUIPMENT AND SOFTWARE	0,09
122010	Public_university institution	COMMISSIONS, FEES AND PROFESSIONAL SERVICES	0,20
131001	Public_technological	NON-TEACHING PERSONNEL	3,03
131002	Public_technological	TEACHING PERSONNEL	3,87
132001	Public_technological	MAINTENANCE AND REPAIRS	0,13
132002	Public_technological	SURVEILLANCE SERVICE	0,35
132003	Public_technological	CLEANING, CAFETERIA AND RESTAURANT SERVICE	0,18
132004	Public_technological	ALLOWANCES, TRANSPORT AND COMMUNICATIONS	0,37
132005	Public_technological	LEASES	0,01
132006	Public_technological	PUBLIC UTILITIES	0,08
132007	Public_technological	STATIONERY AND SUPPLIES	0,31
132008	Public_technological	OTHER INSTITUTIONAL EXPENDITURES	0,46
132009	Public_technological	PURCHASE OF EQUIPMENT AND SOFTWARE	0,02
132010	Public_technological	COMMISSIONS, FEES AND PROFESSIONAL SERVICES	0,57
141001	Public_technical	NON-TEACHING PERSONNEL	0,09
141002	Public_technical	TEACHING PERSONNEL	0,12
142001	Public_technical	MAINTENANCE AND REPAIRS	0,00
142002	Public_technical	SURVEILLANCE SERVICE	0,00
142003	Public_technical	CLEANING, CAFETERIA AND RESTAURANT SERVICE	0,00
142004	Public_technical	ALLOWANCES, TRANSPORT AND COMMUNICATIONS	0,01
142005	Public_technical	LEASES	0,00
142006	Public_technical	PUBLIC UTILITIES	0,01
142007	Public_technical	STATIONERY AND SUPPLIES	0,01
142008	Public_technical	OTHER INSTITUTIONAL EXPENDITURES	0,01
142009	Public_technical	PURCHASE OF EQUIPMENT AND SOFTWARE	0,00
142010	Public_technical	COMMISSIONS, FEES AND PROFESSIONAL SERVICES	0,01

APPENDIX B. Indexes obtained from the ICCV to populate the calculation on maintenance of constructions and buildings of the ICES

	Description
1010300	COMMON SANDFILL
1010500	CONCRETE
1010700	IRON AND STEEL
1010900	WIRES
1011000	CONSTRUCTION TIMBER
1020100	SINKS
1020200	TOILETS
1030200	PLUMBING
1030300	HYDRAULIC ACCESSORIES
1030800	WELDINGS
1040100	ELECTRICAL ACCESSORIES
1040500	LAMPS
1040900	PVC CONDUIT PIPE
1050300	GREY CEMENT
1050400	BRICKS
1050500	MORTARS
1070100	WHITE CEMENT
1080400	DOORS WITH WOOD FRAME
1090200	METALLIC WINDOW FRAMES
1090300	DOORS WITH METALLIC FRAME
1090400	BEAMS
1100100	LOCKS
1100200	IRONWORKS
1100300	GLASSES
1110100	PAINTINGS
1110200	STUCCOS
1130200	TALES
1130400	WATERPROOFING PRODUCTS
1130800	NAILS
2020100	OFFICIAL
3010100	SCAFFOLDING RENTAL
3020100	DUMP TRUCK

Source: DANE

APPENDIX C. Plan of results²⁹

Semiannual change, according to type of institution

Base Index: II semester 2013 = 100

Type	Index		Change first semester (%)	
	II of 2014	I of 2015	I of 2014	I of 2015
Total				
Universities				
University institutions				
Technological institutions				
Technical institutions				

Source: DANE- ICES

Annual change, according to type of institution

Base Index: II semester 2013 = 100

Type	Index		Change first semester (%)	
	2014	2015	2014	2015
Total				
Universities				
University institutions				
Technological institutions				
Technical institutions				

Source: DANE-ICES

²⁹ In order to improve the reading of some output tables, the headers of certain semesters have been included; however the tables allow defining the results in any semester and year (period) of the ICES.

Change and semi-annual contribution of the cost group, according to nature of institution

Base Index: II semester 2013 = 100

Groups	Index			Change first semester (%)			Contribution first semester (p.p)		
	ICES	Private	Public	ICES	Private	Public	ICES	Private	Public
Total									
Personnel expenditures									
Purchase of goods and services									

Source: DANE-ICES

Annual change of the cost group, according to nature of institution

Base Index: II semester 2013 = 100

Groups	Public institutions			Private institutions		
	Index		Change I semester (%)	Index		Change I semester (%)
	I of 2014	I of 2015	2015	I of 2014	I of 2015	2015
Total						
Personnel expenditures						
Purchase of goods and services						

Source: DANE-ICES

Change and semi-annual contribution, according to cost group

Base Index: II semester 2013 = 100

Groups	Index		Semiannual change (%)		Semiannual contribution (p.p)	
	II of 2014	I of 2015	I of 2014	I of 2015	I of 2014	I of 2015
Total						
Personnel expenditures						
Purchase of goods and services						

Source: DANE - ICES

Semiannual change and contribution of the personnel expenditures group, according to cost subgroups and classes

Personnel expenditure (%)					
Subgroups			Cost class		
Description	Change (%)	Contribution	Description	Change (%)	Contribution
Teaching personnel			Adjunct instructors		
			Professors and researchers other than adjunct instructors		
			Head professors		
			Class monitors and assistants		
Non-teaching personnel			Management and professional level		
			Technical and administrative level		
			Administrative services		

Source: DANE - ICES

Semiannual change and contribution of the purchase of goods and services group, according to cost subgroups and classes

Purchase of goods and services (%)					
Subgroups			Cost class		
Description	Change (%)	Contribution	Description	Change (%)	Contribution
Fees and affiliations			Fees		
			Affiliations and associations		
Purchase of equipment and software			Computer and communication equipment		
			Software		
			Office equipment		
Other costs and expenditures			Promotion and dissemination		
			Public relations		
			Supplies for sports, gymnastics and welfare		
			Medications		
			Equipment for employees		
			Insurances		
			Fuels and lubricants		
Stationery and supplies			Office supplies other than stationery		
			Stationery		
			Laboratory supplies		
			Subscription to databases and magazines		
			Photocopies		
			Books		
Maintenance and repairs			Maintenance of constructions and buildings		
			Maintenance of machinery and equipment		
			Maintenance of office equipment		
			Maintenance of computers and communication equipment		
Allowances, transport and communications			Postoffice charges		
			Allowances		
			Air tickets		
			Personnel transport		
			Internet		
			Freight and hauling		
			Mobile phones		
Surveillance			Surveillance contracts with companies		
			Equipment and other surveillance expenditures		
Public utilities			Water supply, sewerage and sanitation		
			Landline telephony		
			Gas		
			Electricity		
Leases			Leases of constructions and buildings		
			Rental of office equipment, computers and transport		
Cleaning, cafeteria and restaurant			Contracts of cleaning and cafeteria with companies		
			Cleaning and cafeteria utensils and supplies		
			Cleaning and cafeteria equipment		

Source: DANE - ICES

APPENDIX D. Consistency specifications of the ICES

CONSISTENCY SPECIFICATIONS STANDARDS TO EVALUATE THE LOGICAL CONSISTENCY OF INFORMATION IN THE FUR OF THE CPI					
DESIGNATION	NAME	FIELD	DESCRIPTION	VALUE	OBSERVATION
IPC01	Number	Numerical	Consecutive printing number	Number	It needs to be
IPC02	City	Text	Identification of the city	Bogotá, Medellín, Cali, Barranquilla, Bucaramanga, Manizales, Pasto, Pereira, Cúcuta, Montería, Neiva, Cartagena, Villavicencio, Riohacha, Armenia, Quibdó,	It needs to be
IPC03	Code	Numerical	Code of the source	Source group, source class, Consecutive	It needs to be
IPC03	Name	Text	Name of the source	Text	It needs to be
IPC03	Address	Alpha-numeric	Address of the source	Street name, number	It needs to be
IPC03	Telephone number	Numerical	Telephone number of the source	Number	
IPC05	Code	Numerical	Code of the item	Expenditure Group, Subgroup, Class Basic expenditure, Consecutive	It needs to be
IPC06	Item-Specification	Text	Specifications for price monitoring	Basic and secondary characteristics	It needs to be
IPC07	Base unit	Alpha-numeric	Quantity and base unit for calculation of prices	Number and unit	It needs to be
IPC08	Previous unit	Numerical	Unit collected in the previous period	Number	Blank value
IPC09	Previous price	Numerical	Price collected in the previous price	Number	Blank Value
IPC10	I.S	Logical	Waiting period	Blank or X	X Blank
IPC11	I.N.	Logical	Waiting period	Blank or X	X Blank
IPC12	C.R	Logical	Waiting period	Blank or X	X Blank
IPC13	P.E.	Logical	Waiting period	Blank or X	X Blank
IPC14	S.I.	Logical	Immediate replacement	Blank or X	X Blank
IPC15	F.C.	Numerical	Complementary source	Number	X Blank
IPC16	Collected unit	Numerical	Current collected unit	Number	Blank value
IPC17	Current price	Numerical	Current collected price	Number	Blank Value
IPC18	Observation	Numerical	List for observations	Number	Blank Number
IPC19	Complementary sources	Alpha-numeric	Name, address and telephone number of the complementary sources	Name, street name, number and telephone number	Name, street name, number and telephone

IPC20	Collection date	Numerical	Collection year, month and day	Date	It needs to be
IPC21	Supervision date	Numerical	Supervision year, month and day	Date	Date Blank
IPC22	Collector's signature	Text	Collector's signature	Signature	It needs to be on hardcopy
IPC23	Supervisor's signature	Text	Supervisor's signature	Signature	It needs to be on hardcopy Blank
IPC24	Respondent's signature	Text	Respondent's signature	Signature or seal	It needs to be on hardcopy FUR
IPC25	Back of the FUR	Text	Field for observations	Text	Text Blank

Source: DANE - ICES