Box 1
Regional Economic Pulse: High-Frequency, Short-Lag Indicators to Understand Local Economies

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Banco de la República made public the Regional Economic Pulse series (PER for its Spanish acronym)[1] on its website in December 2023. The technical staff of the Bank created this new economic indicator, which is released once a month, includes national and regional series, and its lag is approximately twenty days after the measurement month. The PER includes a set of short-term indicators that measure the economic performance of seven domestic regions, the national aggregate, and six economic activities. This indicator is constructed based on perception surveys carried out among leaders of companies, trade guilds, and institutions operating in the country. This information is complemented with geographically disaggregated statistics that are available timely to calculate the indicators.

Although Colombia has regional statistical information for some sectors or aggregates, in most cases, the time lag of these series exceeds forty-five days, or they are low-frequency indicators, which prevents knowing in real time what is happening in the economy. The PER differs because of its short time lag and the regional disaggregation, thus providing a timely measure of the country's economic activity based on segmented information from various regions of Colombia. In this way, the PER provides valuable information for decision-making by economic policymakers and enriches the knowledge and comprehension of the country's economy, having been sourced through first-hand contact with business leaders in the regions.

1. Background

Banco de la República, in its mission to preserve the purchasing value of the currency in coordination with general economic policy, also has unique functions, such as generating knowledge and information that contribute to decision-making. In a country with such diverse regions as Colombia, increasing the monitoring and timely analysis of local economies is deemed highly relevant for monitoring the national economy.

The PER began from the notion of adapting the *Beige Book* of the U.S. Federal Reserve, a qualitative report on current economic conditions across the twelve Federal Reserve Districts, to the Colombian situation. The *Beige Book Report* is published eight times a year and presented before each Federal Open Market Committee (FOMC)[2] meeting, where economic policy decisions are made. These documents are constructed from various relevant sources, including local interviews with business and financial leaders, economists, and market

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1. Available in Spanish only at: https://www.banrep.gov.co/es/estadisticas-economicas/pulso-economico-regional

2 Federal Reserve Board. Frequently Asked Questions

experts, among others, which are collected by each district through formal and informal methods. The sources are carefully selected to receive accurate and objective information on various economic activities.

From this perspective, in 2010, *Banco de la República* began collecting information on the economic activity of various areas in the country, a task carried out by the seven regional economic research centers the entity has nationwide. Utilizing a format like the *Beige Book*, perception surveys were conducted with the most influential regional business leaders, who are aware in real time of the productive performance of the firm they represent, the conditions of their environment at a moment in time, and the origins of the behaviors they reference. The first pilot reports were generated for some areas of the country where it was feasible to conduct these interviews with the necessary periodicity and timeliness. Additionally, the activities, regions, and follow-up variables were defined, considering previous studies on the economic makeup of each region[3] and the feasibility of contacting several leaders in each region.

Subsequently, given the need to create economic indicators that could provide a timely measurement of economic activity, a new numerical indicator was constructed and calculated based on the information collected. Hence, at the end of 2012, the monthly economic activity indicator called the Regional Economic Pulse (PER for its Spanish acronym) was created and gradually implemented for different regions of the country[4].

2. Methodology

The indicator is constructed with two kinds of information: 1) qualitative, which comprises most sources and is gathered through perception surveys, and 2) quantitative, gathered from public and private data disaggregated by region and available with short lag. Given that the PER seeks to measure short-term fluctuations, the questions in the perception surveys are directed to obtaining information on the annual change of the tracked variables, and the regional statistics correspond to the annual variation of the series consulted.

The information sources are leaders of the principal companies, establishments, trade guilds, and institutions that carry out one of the six economic activities monitored in the country's regions (Table R1.1). The design used is a non-probability judgment sampling, meaning that the sample is selected according to the knowledge, experience, and judgment of the PER researcher. In recent years, the indicators have been constructed with a monthly average of 1100 qualitative and quantitative sources. In addition, the disaggregation of the data allows for a theme-based regional, national, and economic activity scope (Table R1.1).

The qualitative information is gathered based on perception questions asked, such as: How did the production volume behave in the month under consideration versus the same month of the previous year? The answer options to the perception survey questions are: increased, fell, or remained stable (no change). In turn, the first two answers include further classification as: slight, moderate, significant, or very significant. To calculate this indicator, a value between -1 and 1 is assigned to each of these ratings, with a differential of 0.25.

Quantitative information is normalized to bring annual variations to the interval [-1,1] using scaling method techniques (Shuschny and Soto, 2009) or Box-Cox transformations (Box and Cox, 1964), according to the characteristics of each series. For example, during and after the COVID-19 pandemic, some series used in the PER recorded recurrent extreme annual variations, causing the typical rescaled values to fall within a very narrow range. Following the recommendations of Shuschny and Soto (2009), a specific methodology was developed that integrates the Box-Cox (1964) procedure and an adapted version of the logarithmic transformation to adjust the outliers and bring them to the range of -1 and 1.

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3 Essay on the Regional Economy (ESER for its Spanish acronym), available in Spanish only on *Banco de la República*'s website at banrep.gov.co

4 *Banco de la República's* Regional Branches for Economic Studies area groups the country into seven regions: Antioquia, Southwest, Caribbean, Northeast, Central Coffee, Llanos Orientales, and Bogotá. This grouping considers the similarities in the economic makeup and the geographic proximity of the constituent departments.

Table B1.1
Monitored Regions and Economic Activities

A. Monitored Regions	
Regions	Departments included
Antioquia	Antioquia
Southwest	Valle del Cauca, Cauca, and Nariño
Caribbean	Atlántico, Bolívar, Magdalena, Córdoba, Cesar, Sucre, La Guajira, and San Andrés
Northeast	Santander, Norte de Santander and Boyacá
Central Coffee	Caldas, Quindío, Risaralda, Tolima, Huila and Caquetá
Llanos Orientales	Meta and Casanare
Bogotá	Bogotá and Cundinamarca
National aggregate	All monitored regions
B. Tracking Economic Activities	
Economic activity	Annual change in the tracked variables
Trade	Retail sales volume (including vehicles) and hotel occupancy rate
Industry	Volume of industrial production
Transport	Number of departing passengers and volume of cargo moved by land or air
Agriculture	Volume of agricultural production
Financial	Loan disbursement amounts
Housing	New housing sales in units and number of real estate housing transactions

Source: Created by the authors.

Thus, the PER level ranges from -1 to 1, where values below zero represent a negative annual change, above zero a positive annual change, and values equal to zero indicate no year-on-year change. The extreme value -1 is considered an atypical negative annual change, and the extreme value 1 a historically high positive change. The PER levels do not correspond to percentage changes, given the nature of the indicator (combination of perceptions and quantitative information).

After assigning values to the perception surveys and normalizing the annual variations, the responses are weighted to obtain the result for each economic activity in each region[5]. Accordingly, the result of economic activity *j* in region *i* in month *t* (x_{jit}) is calculated as a weighted sum of the responses, considering the participation of the company or establishment in the economic activity and region in which it operates. Once the computation for activity *j* in region *i* is completed, the PER for each geographic area is the sum of the tracking activities weighted by their weight in the aggregate value of the regional GDP:

$$PER_{it} = \sum_{j=1}^{6} x_{jit} * w_{jit} \ (1)$$

Where PER_{it} is the result of the region's indicator *i* in period *t*, *xjit* is the result of activity *j* of region *i* in period *t*, and w_{jit} is the weighting of activity *j* within the productive structure of region *i*, with $\sum_{j=1}^{6} w_{jit} = 1$.

The national aggregate indicators and its economic activities are based on regional results. Their calculation employs the share of each region's productive structure in the aggregate national GDP. Thus, the PER of the national aggregate (PER_{it}) is equal to the weighted sum of the regional indicators:

$$PER_t = \sum_{i=1}^{7} PER_{it} * z_{it} \ (2)$$

5 All PER weights were calculated considering the business and productive structure of each region in 2013 (the reference base year). In addition, only the responses received for each month are weighted.

Where PER_t is the result of the national aggregate indicator in month *t*, PER_{it} is the indicator of region *i* in period t, and z_{it} is the weighting of region *i* in period *t*, where $\sum_{i=1}^{7} z_{it} = 1$.

The aggregate indicators for each activity are constructed similarly for the national total. The indicator for each national economic activity is the weighted sum of x_{jit}, according to the share of activity *j* of region *i* in the national aggregate of activity *j*:

$$PER_{jt} = \sum_{i=1}^{7} x_{jit} * \alpha_{jit} \quad (3)$$

Where *PERjt* equals the result of activity indicator *j* for the total of the seven regions in period *t;* x_{jit} is the result of activity indicator *j* of region *i* in period *t*, and α_{jit} is the weighting of activity *j* of region *i* in period *t*, with $\sum_{i=1}^{7} \alpha_{jit} = 1$.

As such, the PER is not intended for estimating or forecasting the GDP because of its methodology, geographic coverage, and the specific economic activities it monitors; also, because it does not measure the magnitude or value-added created in the production of goods or services. Nevertheless, it is an indicator that allows us to identify acceleration or deceleration trends in economic activity. In addition, the PER indicator is constantly evolving and may change due to adjustments to sources of information, coverage, calculation techniques, and modifying the base year of the weights, among other factors.

3. Results[6]

The PER statistical series allows us to identify the trends and cyclical fluctuations that characterize each regional economy and the national economy. An analysis of the historic behavior of the PER shows that the indicator registered a period of economic deceleration across all regions during 2016 and 2017 (Graph B1.1). The Antioquia, Northeast, and Central Coffee regions registered the most significant fall in the indicators during this period. These results were affected by the 2016 trucking strike that strongly impacted the transport of passengers and cargo on roadways, which in turn, upset industry through disruptions in the supply of raw materials and hurt commerce due to the limited availability of goods. The negative results were even more pronounced in the Northeast region where, in addition to its affectation by the limited mobility, trade declined further in this region because of the border closure with Venezuela in early 2016. In 2017, regional indicators continued their lackluster performance, impacted by the implementation of the tax reform and its consequent impact on consumption. In this timeframe, the Llanos Orientales region delivered the worst results owing to constant closures on the access road to/from Bogotá.

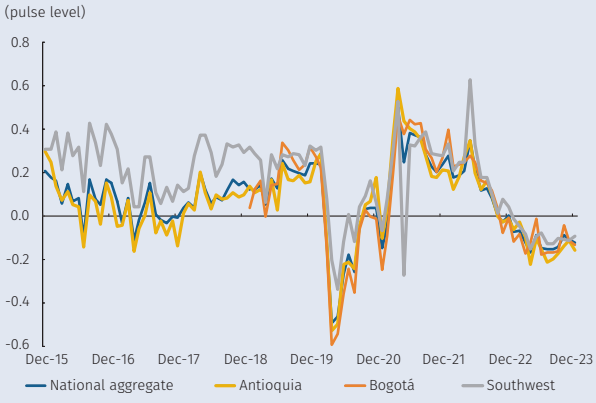
Throughout 2018 and up to the first months of 2020, the Antioquia, Northeast, Caribbean, and Central Coffee regions underscored the positive trend seen in the overall national result. In general, consumer confidence and access to credit propelled domestic demand during 2018 and 2019. They also fueled the Southwestern region, whose results exceeded the national aggregate, driven by industry activity (Graph B1.1, Panels A and B). Conversely, despite showing a similar positive outlook, the indicator for the Central Coffee Region fell below the national result because the *El Niño* phenomenon negatively affected agricultural activity (Graph B1.1, Panel C). Weather conditions also hampered agricultural and livestock production in the Antioquia, Llanos Orientales, and Caribbean regions, particularly in the first half of 2019. The Bogotá region showed positive growth rate in the same year – coinciding with the launch of this region's indicator - primarily due to heightened commercial activity and loan placements.

Since March 2020, mitigation measures to curtail the COVID-19 pandemic, such as operational restrictions in several sectors, mandatory precautionary isolation, and mobility limitations, caused a drastic drop in the indicator throughout all regions. The high and unexpected demand for pharmaceuticals, healthcare, cleaning and disinfection, and personal hygiene products helped the Southwest region halt this decline as the national leader in their production. By October 2020, all regions began a gradual recovery process. Likewise, a rebound was seen in March and April of 2021, given the low comparison base effect, the gradual relaxation of the pandemic-related quarantine, the start of the vaccination process, and the introduction of specific tax incentives (VAT-free days, reduction of the sales tax on airline tickets, and tax exemptions on hotel services). The latter incentives

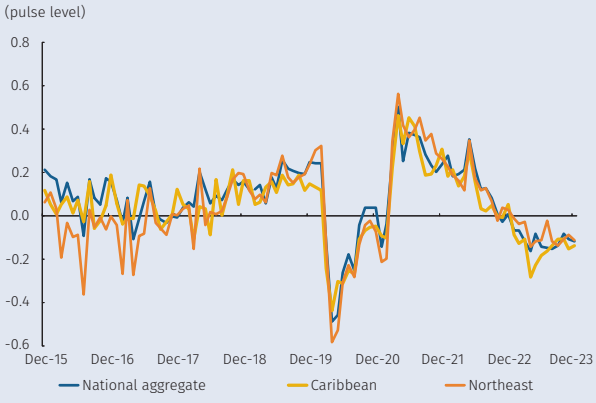
6 The comments of the PER sources explain the behaviors described in this section.

Graph B.1.1
Regional Economic Pulse by region and national aggregate

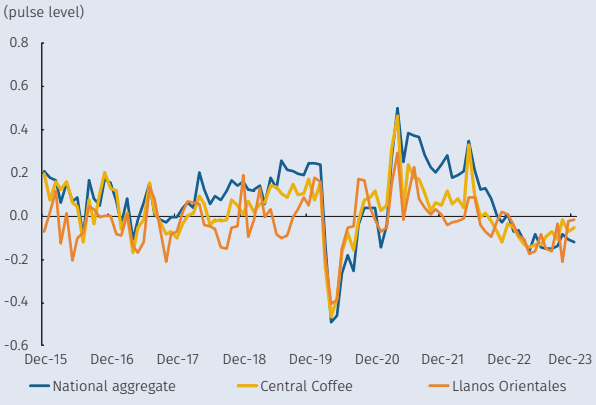
A. Regional Economic Pulse of Antioquia, Southwest, and Bogota Regions



B. Regional Economic Pulse of the Caribbean and Northeastern Region



C. Regional Economic Pulse of the Central Coffee and Llanos Orientales Region



Source: *Banco de la República.*

were primarily reflected in the positive results of the Caribbean region, which relies heavily on tourism.

In May 2021, the road blockades connected to the national strike undoubtedly interrupted economic growth in the Southwest, Central Coffee, and Llanos Orientales regions, heavily limiting the transport of cargo and the supply of raw materials, with the most affected area being the Southwest. Subsequently, economic activity began to return to normal in 2022, accompanied by the reactivation of mass entertainment activities, especially favoring the results of the Bogotá and Antioquia regions.

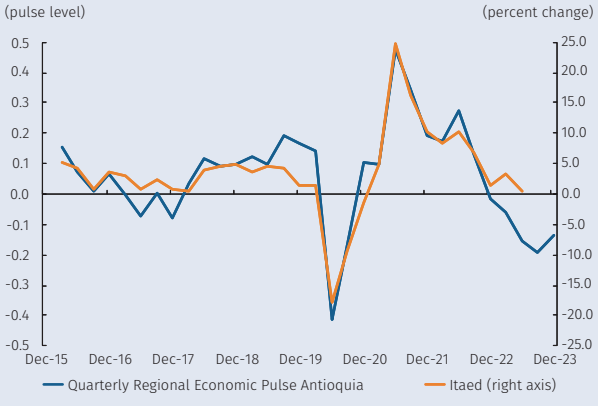
Throughout 2023, the indicators for all PER regions fell to negative territory in an environment of high inflation, elevated interest rates, weakening demand, and changes in the housing subsidy policy. The Caribbean and Central Coffee regions suffered substantially from the closing down of operations by two airlines in 2023, and the Llanos Orientales regions from the multiple blockades of the access road to the capital. Even though it was still in negative territory, Antioquia stood out in 2023 for its slower rate of decline. This was due to both improved milk production, a crucial product of the region's livestock activity, brought on by ideal rainfall conditions, and the increased tourist influx and its parallel impact on commerce.

Finally, although the PER indicators do not pretend to estimate or forecast GDP because of their characteristic methodology, measurement, and coverage, their results have demonstrated some similarities to those of the regional statistics produced by DANE, such as the Quarterly Indicator of Departmental Economic Activity, available for the departments of Antioquia, Atlántico, Valle del Cauca, Santander and Bogotá, as well as with the aggregate

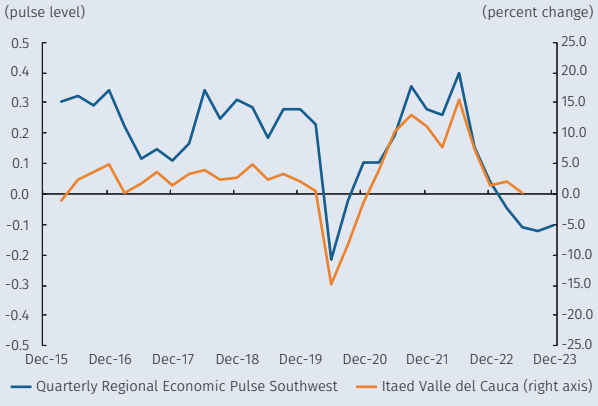
national quarterly GDP for the activities included in the PER[7] (Graph B1.2), demonstrating statistically significant correlations.

Graph B.1.2
Comparisons between the quarterly Regional Economic Pulse by region and the quarterly Indicator of Departmental Economic Activity (Itaed)

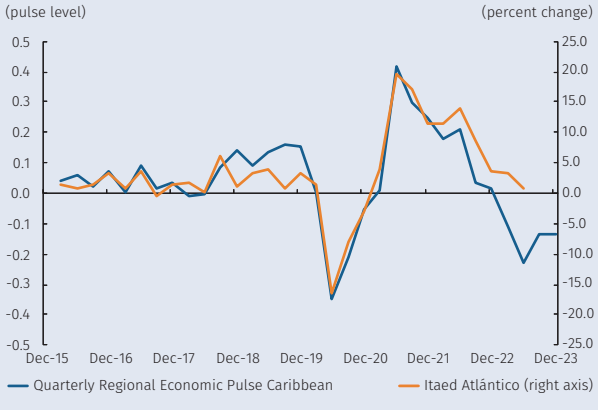
A. Quarterly Regional Economic Pulse and Itaed of Antioquia



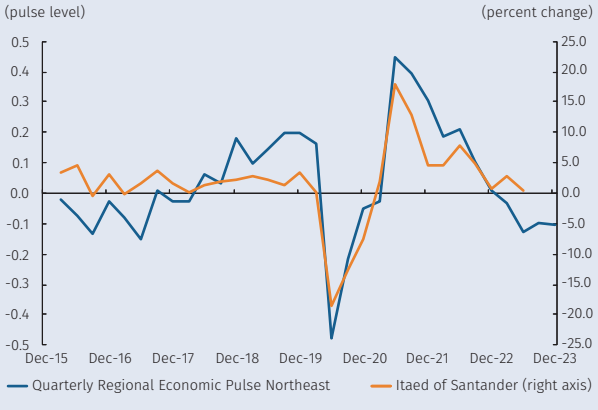
B. Quarterly Regional Economic Pulse of the Southwest and Itaed of Valle del Cauca



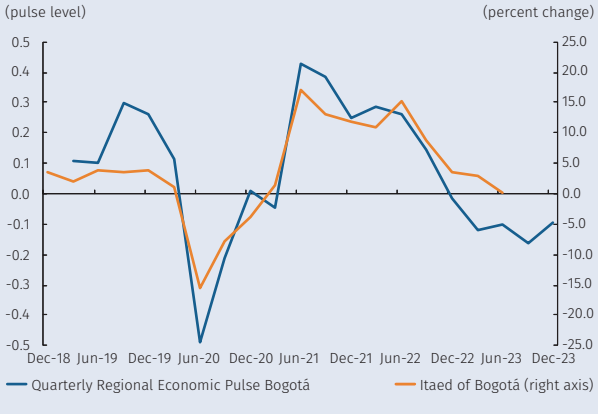
C. Quarterly Regional Economic Pulse of the Caribbean and Itaed of Atlántico



D. Quarterly Regional Economic Pulse of the Northeast and Itaed of Santander



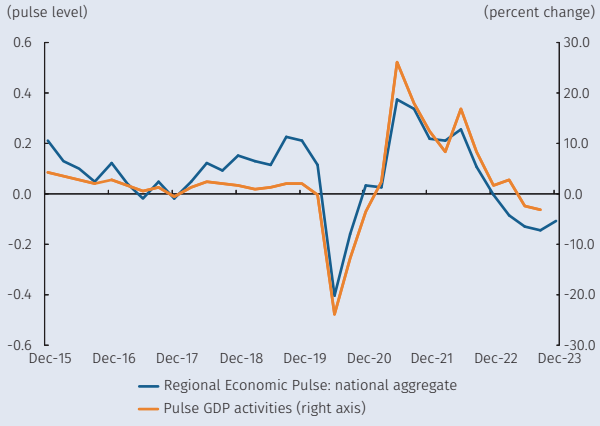
E. Quarterly Regional Economic Pulse and Itaed of Bogotá



Sources: *Banco de la República* and DANE.

7 A comparable national quarterly GDP is constructed, covering the economic activities tracked by the PER. Thus, the national quarterly GDP of PER activities is the sum of the industry value added (excluding the refining industry), commerce, lodging, agriculture, livestock, air and land transportation, building construction and financial activities.

Graph B.1.3
Quarterly Regional Economic Pulse national aggregate and Pulse GDP activities



Sources: *Banco de la República* and DANE; calculations by *Banco de la República*.

Likewise, inferential tests[8] carried out on the PER and DANE[9] series concluded that they share comovements, demonstrating that the PER can capture the economic activity trends of the regions, the national aggregate, and the tracked economic activities (Graph B1.3).

References

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8 Granger test (causality), Engle-Granger test (cointegration) and Pearson test (correlation).

9 The PER indicators were compared with the economy monitoring indicator, real sales by department from the Monthly Trade Survey and real production from DANE's Monthly Manufacturing Survey with a Territorial Approach.