

Economic Analysis

In Mexico, GDP measured on the demand side tells a very different story from that measured on the supply side

The matching of GDP growth rates measured by expenditure components and that measured by production value has deteriorated consistently, and recently more sharply

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- In practice, GDP growth measured on the supply side should be very similar to that measured by expenditure components; in Mexico, this is not the case. Although the parallel between the original series is high with seasonally-adjusted series, one may even grow when the other decreases, which significantly hinders economic analysis
- The deterioration in the pairing shown by both measurements in Mexico suggests that it is time for INEGI to move the measurement of GDP to the methodology that aggregates the expenditure components, similar to that used by the *Bureau of Economic Analysis* in the US
- Together with the measurement of GDP by expenditure components, it is essential to change to the indirect seasonal adjustment method to ensure that economic growth can be easily interpreted in terms of the development of private consumption, government consumption, private and public investment and net exports

According to INEGI, in 1Q19, economic activity grew -0.3% (QoQ) in seasonally-adjusted series. In the same period, private investment grew by 0.7%, while private consumption grew by 0.2%.¹ Both components of GDP represent 87% of economic activity and, despite good performance in the quarter, the economy contracted. This inconsistency between the evolution of growth by the expenditure components (on the demand side) and the measurement of growth by production value (on the supply side) is not new.² What is new is that the inconsistency between the growth rates of both measurements has worsened over time. In recent years, the association and matching of quarterly GDP growth rates as measured by the demand components and the supply side has deteriorated in the seasonally-adjusted series.³ The debate on the choice of the seasonal adjustment method (direct or indirect) is valuable and should continue. On the one hand, the discussion should encourage a review of the methodology used for seasonal adjustment considering that the relationships linking components to the aggregate appear to have weakened in recent periods. On the other hand, consideration should be given to the adoption of the indirect method used in the US and other European countries (BEA 2019, Ladiray & Mazzi 2003).

¹ Despite the magnitude of net export growth in the period (-48.5%), they represent less than 1% of GDP.

² Since INEGI measures GDP by production value and estimates the expenditure components, leading to statistical differences.

³ Inconsistency not observed in the original series.

Discrepancies between the direct and indirect seasonal adjustment method

As documented in the literature on the subject, the estimation of seasonal effects may vary depending on the econometric methodology or the computational program used.⁴ In an aggregate series such as GDP, the estimation of seasonal effects may also vary depending on whether the direct or indirect method is used (Hood & Findley 2001). The direct method means the direct application of the seasonal adjustment methodology to an aggregate series. The indirect method means the application of the seasonal adjustment methodology to each of the components of the series in question and then adding (by sum or weighted average) the seasonally adjusted components to obtain the aggregated series with seasonal adjustment indirectly.

INEGI adjusts all activity indicators directly, i.e. it performs seasonal adjustment for the aggregate series and for each of the components separately. Thus, in the case of GDP, it provides the series with seasonal adjustment by the direct method on the measurement of the activity it carries out through the quantification of the total value of the production (GDP on the supply side). It also provides the seasonally-adjusted series of production value of each sector and sub-sector of economic activity independently (components). The same procedure is used to approximate each component of expenditure: private and public consumption, private and public investment, exports and imports. The measurement of activity on the aggregate demand side is then obtained by adding the components of seasonally-adjusted expenditure (GDP on the demand side). The alternative, used in the US and some European countries, is the indirect method, which would mean deriving the economy's total seasonally-adjusted production value from the sum of the seasonally-adjusted series value of each sector or expenditure component. Thus, the sum of the components always coincides with the total, which facilitates analysis of the evolution of economic activity. As discussed below, we consider it appropriate to use this approach in Mexico.

As shown in the literature on the subject, seasonal adjustment is often not the same in the two methodologies. Discrepancies between the direct and indirect method often arise because the seasonal patterns of each component and aggregate are different, or because the model for decomposition is additive for some series and multiplicative for others, among other factors (Guerrero et al, 2018). In this sense, it is not unusual to observe a discrepancy between growth rate of the aggregate series and the growth rate of the sum of the components. However, empirical evidence for GDP in Mexico shows that the association and pairing of the trend of the two rates has deteriorated over time, making it difficult to identify the factors responsible for growth levels.

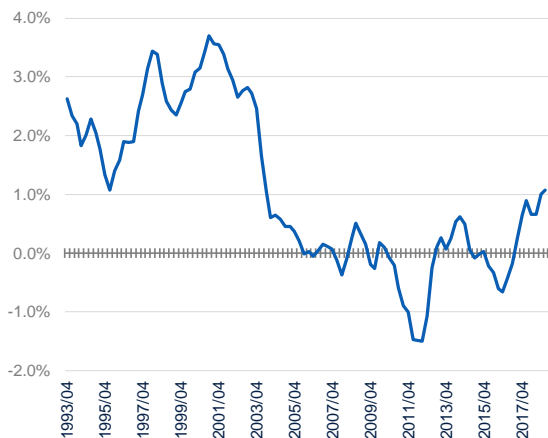
From a practical point of view, the ideal scenario is that growth in economic activity is easily interpreted in terms of the development of the expenditure components, that is, the performance of private consumption, government consumption, public and private investment, and net exports. Greater inconsistency between GDP growth on the supply side and GDP on the expenditure side implies greater difficulties in interpreting the factors that are affecting or favoring growth in the period in question. The signs point to the weakening of the relationships linking components to the aggregate by adding the seasonally-adjusted series, which is paramount from the perspective of the interpretation of results (Guerrero et al, 2018).

⁴ The methodology currently used by INEGI is called X-13ARIMA-SEATS.

How the expenditure components and GDP by production value tell a different story about growth in Mexico

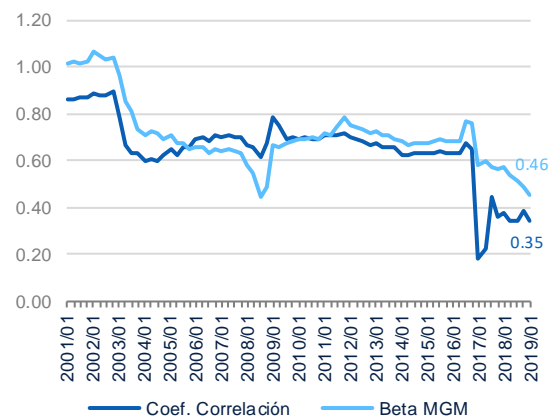
To examine the degree of association between the quarterly GDP growth rate by expenditure components and GDP growth on the supply side, Pearson's correlation coefficient was estimated between the two variables, using 32-quarter (8-year) mobile windows⁵, with seasonally-adjusted series. Along with the correlation test, the ability of GDP by expenditure components was estimated to explain the contemporary movements observed in GDP on the supply side, using the generalized method of moments (GMM)⁶ and using 32-quarter mobile windows. The study period included 1Q93 to 1Q19.

Figure 1. **GDP Discrepancy: Supply vs Demand Side**
(%GDP, with seasonally-adjusted series, moving average 4 quarters)



Source: BBVA Research/INEGI

Figure 2. **Correlation Coefficient and β -GMM**
(QoQ% of GDP by expenditure component vs. QoQ% of GDP by production value)*



Source: BBVA Research

*32-quarter windows; the date on the horizontal axis corresponds to the last quarter (closing quarter) of each window.

The results of recent years are not encouraging. The correlation coefficient between the two series reduced from a maximum of 0.86 during the first study window (1Q94-1Q01) to 0.35 in the last window (2Q11-1Q19)⁷. These figures imply a 60% reduction in the degree of association between economic growth by expenditure component and economic growth on the supply side, measured quarterly (Graph 2). In the same vein, the capacity of GDP by expenditure component to explain the changes observed in GDP by production value has reduced over time: while the β -coefficient of the GMM estimate reached a maximum of 1.06 in 1Q02, it begins to show a reduction in 1Q17, reaching 0.46 in 1Q19. This means that, in the last eight years, a 1.0 percentage point (pp) increase in GDP growth by expenditure component is associated with an increase of only 0.46 pp in GDP growth by production value.⁸

⁵ It was decided to use 8 years, with a minimum of 32 observations per estimate. Methodology known as "rolling windows."

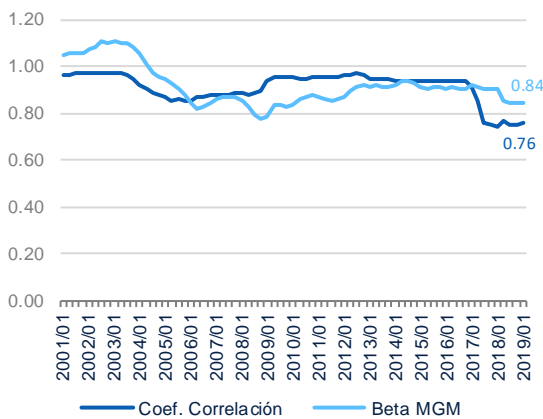
⁶ Robust estimation of heteroscedasticity and self-correlation of errors.

⁷ Pearson's correlation coefficient considering the entire study period is 0.74%.

⁸ Confidence level 99%.

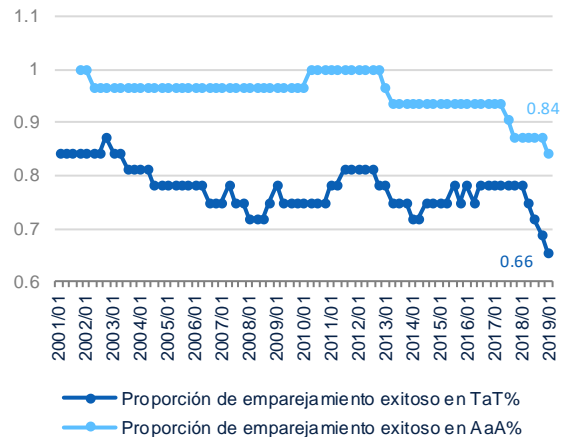
As is common in short time series, patterns of percentage variations from one quarter to another tend to be more irregular than annual GDP growth rates. In these cases, it is most common to use a technique that enables these effects to be corrected, also known as a smoothing technique. In the present case, the smoothing technique is the moving average of four quarters of the quarterly growth rate, thus the effects for a full year are averaged. The smoothed series show an improvement in terms of association and explanatory power of GDP by the expenditure components, as the correlation coefficient for the last window increased from 0.46 to 0.84, and the regression coefficient β increased from 0.35 to 0.76 (Graph 3).⁹ Although this is an improvement, one of the previous findings persists: since 2017, the degree of association between growth by expenditure components and growth by production value has reduced systematically, weakening the explanatory power of the growth by expenditure components. With the smoothed series, the linear regression coefficient moves drastically away from 1.0 as of 3T17, and it has remained relatively unchanged since then. Similar results are obtained by using the inter-annual growth rate as a technique for smoothing the series.

Figure 3. **Correlation Coefficient and β of GMM** (QoQ% of GDP by components vs. QoQ% of GDP by production value, estimates with four-quarter moving average smoothed series)*



Source: BBVA Research/INEGI
*32-quarter windows; the date on the horizontal axis corresponds to the last quarter (closing quarter) of each window.

Figure 4. **Cases of Successful Matching** (% of total quarters per window, trend in GDP growth by expenditure components vs. trend in GDP growth by production value)*



Source: BBVA Research/INEGI
*32-quarter windows; the date on the horizontal axis corresponds to the last quarter (closing quarter) of each window.

In addition to the loss of explanatory power of the measurement of GDP by expenditure components, the pairing between the sign of the quarterly growth for this variable and that of GDP measured by production value has also decreased. In the first analysis window (2Q94-1Q01), GDP growth by expenditure component showed the same sign as GDP growth on the supply side 84% of the time, that is, in 27 of the 32 quarters (Graph 4). By the last window (2T11-1T19), match cases reduced to 66% (21 of 32 quarters considered). The proportion of success in matching has declined steadily since 2Q18. The most recent case is reflected in the figures for 1Q19. In the first quarter of this year, the quarterly variation in GDP with seasonally-adjusted figures was -0.3%, while GDP per component of expenditure

⁹ Confidence level 99%.

grew by 1.0% in the same period. Calculation using inter-annual growth rates as a smoothing technique for the series has similar results: the pairing of the trend between GDP growth by expenditure components and GDP growth by production value has worsened since 2018 (Graph 4). In inter-annual rates in 1Q19, GDP grew by 0.1%, while GDP per component of expenditure showed a -0.2% variation. Is it noise or signal?

Toward better seasonal-adjustment of GDP

The weakening of the association and the pairing between the growth of the activity measured by expenditure components and growth measured by production value observed in the seasonally-adjusted series encourages discussions about the appropriate methodology for seasonal adjustment. An initial review can be performed to determine different choices available in the program used (X-13ARIMA-SEATS in the case of INEGI), such as additive or multiplicative decomposition, for example. According to Guerrero et al (2018) it is fundamental to select the right type of transformation to apply to the series in the seasonal adjustment process, which depends on distributional assumptions that must be validated by the data. A second review can be performed to determine the level of aggregation to which the seasonal adjustment will be made, resulting in a choice between the direct or indirect method (Hood & Findley 2001). If components share no similar characteristics or if their relative importance is changing rapidly, then indirect adjustment should be preferred. If, on the other hand, the components show the same seasonal factor and approximately the same peaks and troughs, then the direct adjustment is adequate, as it will produce a smoother series without loss of information (Ladiray & Mazzi 2003).

The best measure of the quality of the seasonal adjustment of the series is that there are no estimated seasonal effects still present in the adjusted series; the presence of seasonal effects in the seasonally adjusted series is called residual seasonality (Hood & Findley 2001). The discussion on the existence of residual seasonality in the seasonally adjusted GDP series will not be addressed here, but it is an important line of research for the future. The relative importance of the different activity sectors and/or expenditure components may be changing faster than anticipated; some components are likely to be recording seasonal factors that are increasingly less similar to those observed in recent years. In practical terms, the statistical treatment of the series should prioritize the economic interpretation of the movements of the variables, which ultimately represent the reading of the trends shown by the series on the development of economic activity. Thus, the recent inconsistency between the different growth measurements lays the foundation for INEGI to move toward a measurement of economic activity by expenditure components, and to the use of the indirect seasonal adjustment method.

References

- BEA. 2015. A Snapshot of the Seasonal Adjustment Process for GDP. Available at: <https://www.bea.gov/news/blog/2015-06-10/snapshot-seasonal-adjustment-process-gdp>. Retrieved: August 21, 2019.
- Ladiray, D. & Mazzi, G. 2003. "Seasonal Adjustment of European Aggregates: Direct versus Indirect Approach." En Manna, M. & Peronaci, R. (Ed.), *Seasonal Adjustment*, European Central Bank, p. 37-66.
- Guerrero, V., López-Pérez, J., & Corona, F. 2018. "Ajuste estacional de series de tiempo económicas en México." (Seasonal adjustment of economic time series in Mexico) *Realidad, Datos y Espacio: Revista Internacional de Estadística y Geografía* (Reality, Data and Space: International Journal of Statistics and Geography), INEGI, vol. 9, No. 3, p. 84-110.
- Hood, C. & Findley, D. 2001. "Comparing Direct and Indirect Seasonal Adjustments of Aggregate Series." *United States Census Bureau Working Paper*.

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