

Regional price dynamics in Argentina (2016–2019)

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This work investigates compliance with the Law of One Price (LOP) across regions of Argentina. A convergence and cointegration analysis of the 2016–2019 period is conducted using the series of the Total Basic Basket (TBB) and the Consumer Price Index (CPI) published by the National Institute of Statistics and Census (INDEC in Spanish) on a monthly basis for six regions in Argentina. The results suggest the existence of convergence in prices and cointegration across regions, which is consistent with compliance with the LOP. This is especially relevant for its potential impact on regional poverty disparity. Indeed, if poorer regions with lower prices tend to have a greater increase in price levels – and therefore convergence is observed – this may imply an increase in regional disparities.

Keywords:

Law of One Price,
convergence,
regional disparities

Introduction

In economics, the Law of One Price (LOP) states that the price of the same good expressed in the same currency in two different markets should be the same under conditions of competition and without considering transport costs or tariffs (Krugman–Obstfeld 1991). Compliance with the LOP has frequently been studied through analyses comparing price convergence in different countries (Hyvonen 2004, Buseti et al. 2007, Dreger et al. 2007, García-Hiernaux–Guerrero 2015) but to a lesser extent at the intra-national level (Cecchetti et al. 2000; Honohan–Lane 2003, Beck et al. 2009, Gómez Aguirre–Rodríguez Chávez 2014).

Verification of the LOP is more feasible at the intra-national level given the lower transport costs in relation to international trade, the absence of barriers to domestic trade, and the use of the same currency (Dayanandan–Ralhan 2005, Liu et al. 2018). Non-compliance with the LOP at the intra-national level is especially relevant since it implies the presence of regional imbalances, the poor allocation of resources, and differences in the cost of living, which must be taken into account in the system of government transfers (Vashchuk 2003). Further, the persistence of intra-national regional imbalances is of growing interest among researchers (Csete–Szabó 2014).

Much research has been conducted to empirically verify the LOP. In this regard, Liu et al. (2018) find evidence of price convergence across Chinese provinces between 2003 and 2015 using a sequential panel selection method. Convergence across cities in Mexico has been reported for the periods 1982–2000 using unit root tests (Sonora 2005) and 1982–2012 through ordinary least squares regression (Gómez Aguirre–Rodríguez-Chávez 2014). Similar results have been found among cities in the United States (Sonora 2008, Huang et al. 2012, Hegwood–Nath 2013). Also in the U.S., empirical evidence has shown the positive effect of e-commerce on regional price convergence (Cavallo 2018).

On the other hand, cointegration techniques have frequently been used to test the validity of the LOP (Goodwin 1992, Jung–Doroodian, 1994, Alavalapati et al. 1997, Kuiper et al. 2002, Silverstovs et al. 2005, Yang et al. 2015, Arruda et al. 2018). Thus, if compliance with this law is accepted, prices in different regions or countries are expected to follow a common long-term trend (that is, they have a similar dynamic) and, therefore, be cointegrated. In this regard, Marcal et al. (2003) found no evidence of cointegration across provinces of Brazil for the 1980–1994 period when using the Johansen cointegration test (1996). Palaia and Holand (2010) extend the analysed period (1980–2006) and admit the possibility of structural breaks following Gregory and Hansen (1996). However, they find no evidence of cointegration.

Lema and Brescia (1998) analyse the cointegration of agricultural prices between Argentina and the United States for 1991–1997 using the test proposed by Engle and Granger (1987) and find results consistent with the idea of cointegration of the series. Also, for Argentina, Daruich and Kozłowski (2019) analyse prices of 22 grocery chains between 2016–2018. Interestingly, a price variance decomposition shows that most of the variance is due to differences across chains and to a lesser extent due to regional differences across stores in the same chain. The above suggests a uniform pricing across regions consistent with the LOP. However, some caveats must be made: these chains have a small number of stores in the poorest areas and they may use subdivisions within the chain to discriminate prices.

Argentina is widely recognized for its territorial disparities; the provinces of northern Argentina have a lower level of development than their central and southern peers. Northern Argentina (Norte Grande Argentino, [NGA]) includes the Noreste ([NEA], Misiones, Corrientes, Chaco, and Formosa) and the Noroeste ([NOA], Salta, Jujuy, Tucumán, Santiago del Estero, Catamarca, and La Rioja). Disparities can be observed in indicators such as infant mortality, life expectancy, gross domestic product (GDP), access to basic services, and poverty (Longhi–Osatinsky 2017, González–London 2018, González 2019).

The wide regional disparities have also manifested in price differences within Argentina. In fact, the provinces of the NGA have presented lower prices and costs

of living than the other provinces (INDEC 2002). This translates, for example, into lower monetary poverty lines for the NGA (INDEC 2019a).

After its re-normalization, INDEC published monthly reports in 2016 on the cost of living disaggregated by region.¹ These monthly reports confirmed that the provinces of the NGA have the lowest price levels, while the provinces of Patagonia have the highest levels. Previously, it was only possible to approximate regional price differences based on household expenditure surveys carried out at irregular intervals of 5–8 years such as the National Household Expenditure Survey (ENGHo in Spanish) conducted in the years 1996/97, 2004/05, 2012/13, and 2017/18.

In this context, the present work seeks to analyse compliance with the LOP across regions of Argentina considering the 2016–2019 period. For this, regression techniques are used to test convergence in the cost of living as reported by INDEC. In addition, a cointegration analysis of the series is considered. Hereinafter, section 2 presents the methodology and sources of information. Section 3 describes the results, and section 4 discusses the main conclusions.

Methodology and sources of information

Considering the objective of this work, ordinary least squares regression analysis is used to test the existence of convergence. This estimation strategy has the advantage of generating more reliable results in small samples than other strategies such as the Generalized Method of Moments (Bao–Dhondge 2009). In particular, the following equation is estimated (Vashchuk 2003, Gómez Aguirre–Rodríguez-Chávez 2014):

$$\ln\left(\frac{P_{it}}{P_{i,t-1}}\right) = \alpha + \beta \ln(P_{i,t-1}) + \rho_i + \sigma_t + \varepsilon_{it} \quad (1)$$

where $\ln(P_{it})$ is the natural logarithm of the chosen price variable (P) in region i in month t ; ρ_i are region fixed effects; σ_t are time fixed effects; and ε_{it} is the error term of the model. If there is price convergence, a negative β coefficient is expected. In turn, the speed of convergence can be estimated as (Egri–Tánczos 2018, Halka–Leszczynka-Paczesna 2019):

$$\lambda = -\ln(1 + \beta) \quad (2)$$

A related measure is the *half-life* indicator that reflects the number of periods – months, in this case – after which 50% of the price shock is eliminated:

$$o = \ln(2)/\lambda \quad (3)$$

While price indices are often used to test convergence, Vashchuk (2003) states that they should be used with caution. In particular, assuming that the price level of all observational units (cities, regions, countries, etc.) being the same in the base

¹ INDEC's reports between 2007 and 2015 should be considered with reservations, as demonstrated by Miranda-Zanetti et al. (2019) and González (2020).

period may not be realistic. The foregoing may introduce bias in the choice of the base period and is a reason to prefer the use of nominal prices instead of indices. The following section describes the price variable (total basic basket) used in the regressions.

Sources of information and regionalization

In the Argentine case, INDEC publishes monthly reports that attempt to approximate the cost of living (in local currency) through the use of a total basic basket per equivalent adult, which includes food and non-food expenses, for regions of Argentina. The considered regions are: the NEA, NOA, Cuyo (Mendoza, San Juan, and San Luis), Centro (Córdoba, Entre Ríos, Santa Fe, La Pampa, and Province of Buenos Aires), Gran Buenos Aires – also known as region Metropolitana – ([GBA], the City of Buenos Aires, and its suburbs), and Patagonia (Rio Negro, Chubut, Neuquén, Santa Cruz, and Tierra del Fuego). The value of the total basic basket is used as input for the construction of a price panel by region. The period under study covers April 2016 to June 2019. Therefore, the panel has 228 observations (region-month combinations).

Simultaneously, since December 2016, a consumer price index has also been made available for regions of Argentina published by INDEC (INDEC 2019b). The CPI quantifies monthly variations of the price level. Unlike the TBB, which is a weighted average of prices, the CPI is an index and therefore has no unit of measure. In addition, the CPI attempts to capture changes in the prices of all goods and services in the economy and therefore has greater breadth than the TBB.

As presented in Figure 1, the Argentine regions cover 24 provinces, including the City of Buenos Aires. The Centro region has the largest proportion of GDP and population, with 66% and 75%, respectively (INDEC 2004, 2010). On the other hand, the NOA and NEA regions have a lower participation in the GDP than their population contribution, with 4% and 6% of GDP and 9% and 12% of population respectively. This accounts for the existence of deep regional disparities in Argentina.

Figure 1

Argentine regions



Source: National Institute of Statistics and Census.

Results

First, the results that arise from estimating equation 1 for regions in Argentina are presented in column 1 of Table 1. Column 2 presents alternative estimates for absolute β -convergence (without regional fixed effects):

Table 1

Convergence in prices across regions of Argentina (2016–2019)

	(1) Coefficient	(2) Coefficient
Estimated β	-0.0384*** (0.00599)	-0.0003** (0.00013)
Regional fixed effects	Yes	No
Time fixed effects	Yes	Yes
N	228	228
R ² overall	0.14	0.98

Note: * significant at 10%, ** significant at 5%, *** significant at 1%.

Source: Author's elaboration based on INDEC.

A negative and significant estimated coefficient is observed in both cases, which is consistent with the idea of price convergence across Argentine regions. When considering an absolute β -convergence specification (column 2), the estimated coefficient is considerably closer to zero compared to the conditional specification with regional fixed effects, which denotes a lower convergence rate. The estimated coefficients of regional fixed effects of equation 1 (Table 5 of the Annex) confirm that Patagonia has the highest prices and the NEA and NOA regions have the lowest ones, on average. Also, the results are robust when considering alternative periodisations (Table 6 of Annex).

Using the previous results to estimate equations 2 and 3, the following is obtained: the average convergence rate is 3.9% monthly, that is, 3.9% of the deviations from the average are eliminated each month. In turn, the half-life indicator suggests that after 17.7 months, 50% of the distortions are eliminated.

Second, and as a robustness exercise, equation 1 is re-estimated using the consumer price index published by INDEC as the dependent variable. As mentioned above, the choice of the base period may bias the estimates and, therefore, should be considered with reservations.

Table 2

Convergence in prices considering the CPI for regions of Argentina (2016–2019)

	Coefficient
Estimated β	-0.0347*** (0.00900)
Regional fixed effects	Yes
Time fixed effects	Yes
N	204
R ² overall	0.93

Note: * significant at 10%, ** significant at 5%, *** significant at 1%.

Source: Author's elaboration based on INDEC.

When using the CPI as the dependent variable in the regression, the result of convergence across the regions of Argentina is repeated. Interestingly, the estimated coefficient is similar to that presented in Table 1. The goodness-of-fit of the model improves significantly compared to the previous case. When estimating equations 2 and 3, a slightly lower convergence rate is observed: 3.5% of the deviations from the mean are eliminated every month and the average life indicator is 19.6 months. This shows that the pace of convergence is higher among goods with greater weight in household spending, such as food and beverages, and included in the TBB than among the overall set of prices in the economy.

A complementary cointegration analysis of the TBB regional series was then conducted. First, the order of integration of the series is analysed and it is observed that all are integrated in order 1; that is, they are not stationary in levels but in first differences. Table 3 presents the results of the Dickey-Fuller test ([ADF], (Dickey-Fuller, 1979) considering a trend component. Alternatively, other specifications were considered obtaining similar results.

Table 3

P-values for price stationarity analysis by region with ADF test

Region	First difference
GBA	0.0177
NEA	0.0073
NOA	0.0053
Cuyo	0.0097
Centro	0.0142
Patagonia	0.0076

Note: the null hypothesis of the ADF test is that the series have a unit root and therefore are non-stationary.

Source: Author's elaboration based on INDEC.

It is observed that all series are stationary in first differences at 5%. Thus, given the evidence that the series have the same order of integration, we proceed with the formal analysis of cointegration following the proposal of Engle and Granger (1987):

Table 4

Cointegration of regional price series in Argentina (2016–2019)

Region	GBA	NEA	NOA	Cuyo	Centro	Patagonia
GBA	--	-3.656**	-3.297*	-3.686**	-3.148	-3.800**
NEA		--	-3.756**	-3.527**	-3.367*	-2.892
NOA			--	-3.785**	-3.172*	-2.967
Cuyo				--	-3.318*	-3.275*
Centro					--	-3.904**
Patagonia						--

Note: the null hypothesis of the cointegration test is that the series are not cointegrated. The critical values of the test are: -4.2 (at 1%), -3.5 (at 5%), and -3.158 (at 10%). Since the matrix is symmetric, the complete matrix is not presented to avoid duplication.

Source: Author's elaboration based on INDEC.

The cointegration hypothesis is maintained for regions of Argentina at 10%. The exceptions are the cases of Greater Buenos Aires-Centro (although with a statistic value very close to the critical value) and Patagonia-NEA/NOA. This is expected considering that Patagonia has the highest price levels, while the provinces of northern Argentina (NEA and NOA) have the lowest prices.

Conclusions

This work has analysed Argentine regional price dynamics between 2016–2019. It was observed that Argentina has wide territorial disparities, which translates into worse living conditions, income, and education, among others in the northern provinces of the country (Noreste and Noroeste regions).

Since 2016, the national institute of statistics (INDEC in Spanish) has published monthly reports on the cost of living in Argentina by region. At the same time, INDEC began to elaborate price indices by regions (previously only a representative index of the Gran Buenos Aires region was calculated). These data allowed compliance with the Law of One Price across Argentine regions to be empirically tested.

First, a formal convergence analysis was carried out considering the cost of living in Argentine regions. The results showed evidence of conditional and absolute β -convergence for the analysed period. The convergence rate was estimated at 3.9% monthly, equivalent to a half-life of the discrepancies of 17.7 months. As a robustness exercise, the previous estimate was reiterated considering the consumer price index (CPI) for Argentine regions. The results were consistent in sustaining the convergence hypothesis, although at a slower rate (estimated speed of 3.5% per month). All of the above suggests compliance with the Law of One Price in Argentina.

Second, the existence of a stable long-term relationship in regional price dynamics was verified. By using the test proposed by Engle and Granger (1987), which allows comparisons to be made between pairs of regions, evidence consistent with the idea of cointegration of the series was obtained. The exception was given by the Patagonia-NEA and Patagonia-NOA pairs, which is expected, given that northern Argentina has the lowest price levels and Patagonia the highest.

In the future, the implications of this price convergence should be analysed in terms of regional poverty disparities. Indeed, in addition to income differences across regions, if prices in the poorest regions increase more rapidly, this implies that poverty disparities are increasing. In the case of Argentina, it was verified that prices are, on average, lower in the poorest regions (the NEA and NOA) and that these tend to converge at some common level with the prices of other regions. On the other hand, and in order to strengthen the results, it is appropriate to extend the period under analysis and, eventually, disaggregate the findings from the subperiods.

Annex

Table 5

Regional fixed effects from equation 1

Region	Coefficient
NEA	–0.0069*** (0.00108)
NOA	–0.0082*** (0.00129)
Pampeana	–0.0003*** (0.00007)
Patagonia	0.0059*** (0.00094)
Cuyo	–0.0019*** (0.00030)

Note: * significant at 10%, ** significant at 5%, *** significant at 1%. The Gran Buenos Aires region is the base category.

Source: Author's elaboration based on INDEC.

Table 6

**Convergence in prices across regions of Argentina (2016–2019)
with quarterly data**

	Coefficient
Estimated β	–0.0258** (0.01047)
Regional fixed effects	Yes
Time fixed effects	Yes
N	13
R ² overall	0.18

Note: * significant at 10%, ** significant at 5%, *** significant at 1%. The values of the total basic basket per equivalent adult were averaged per quarter.

Source: Author's elaboration based on INDEC.

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