

Comparative analysis of unemployment and inflation in Mexico**Analisis comparativo del desempleo y la inflacion en México**

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DOI: 10.35429/JIEC.2019.5.3.27.37

Received June 07, 2019; Accepted November 15, 2019

Abstract

The article examines, based on panel regressions, the long-term relationship between inflation and economic growth based on information for 70 countries and annual data for 1950-2010. The results do not find evidence of a significant trade-off between inflation and long-term growth for this sample and period, except if national experiences with average annual inflations above the annual 65% threshold are included. That is, outside regimes with persistently very high rates of inflation, there is no systematic or significant inverse relationship between inflation and the growth rate of productive activity. The absence of such long-term trade-off for the aggregate panel is far from implying that for any individual economy the inflation undermines its growth only if it exceeds the 65% per annum. The analysis by groups of countries reveals that the value of the threshold of significance is a function of the current monetary regime.

Trade-off, inflation and economic growth, Panel regressions, Monetary regimes, Latin American economies

Resumen

El artículo examina, en base a regresiones de panel, la relación a largo plazo entre la inflación y el crecimiento económico basada en información de 70 países y datos anuales para 1950-2010. Los resultados no encuentran evidencia de una compensación significativa entre la inflación y el largo plazo. crecimiento a largo plazo para esta muestra y período, excepto si se incluyen experiencias nacionales con inflaciones anuales promedio por encima del umbral anual del 65%. Es decir, fuera de los regímenes con tasas de inflación persistentemente muy altas, no existe una relación inversa sistemática o significativa entre la inflación y la tasa de crecimiento de la actividad productiva. La ausencia de tal compensación a largo plazo para el panel agregado está lejos de implicar que para cualquier economía individual la inflación socava su crecimiento solo si excede el 65% anual. El análisis realizado por grupos de países revela que el valor del umbral de importancia es una función del régimen monetario actual.

Compensación, inflación y crecimiento económico, regresiones del panel, regímenes monetarios, economías latinoamericanas

Citation: CASTRO-VALENCIA, Alberto Merced. Comparative analysis of unemployment and inflation in Mexico. *Journal-International Economy*. 2019. 3-5:27-37

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Introduction

The conventional practice of macroeconomic policy since the second half of the twentieth century has been largely shaped by the conviction that inflation is a monetary phenomenon and that there is an inverse relationship between inflation and economic growth in different temporal horizons. Regarding this relationship, three different positions can be identified in the literature.

The first is that moderate inflation can have a favorable effect on capital accumulation due to the portfolio recomposition effect postulated by Tobin (1965). The basic idea of this approach, based on the growth model of Solow (1956) and Swan (1956), is that individuals keep money as an asset, so increases in inflation, by eroding its value faster, induce a portfolio recomposition towards the purchase of physical assets, machinery and equipment for productive activities. This greater accumulation of capital has an impact on an increase in the economic growth rate in the short term.¹ A conclusion in a similar direction can be derived from the notion that growth requires a transformation of the productive structure. This transformation is accompanied by favorable changes in prices or relative profitability of different industries to attract resources - labor and capital - to selected activities. These changes in relative prices may push up the price level.

A second position argues that inflation does not necessarily have an impact, neither favorable nor unfavorable, on long-term economic growth. Among the proponents, already in good time behind this position, is Sidrauski (1967) that based on a model of optimizing agents based on the Ramsey model (1928), where the possession of money is motivated from the flow of services provided, argues that the capital accumulation rate, and therefore the growth of the economy, is independent of the inflation rate. The third position is that inflation is inescapably harmful to economic growth.² This is the most common position today, not only in the business press but among a considerable set of officials in charge.¹ Algan and Ragot (2010) illustrate the Tobin effect in a theoretical model where precautionary savings decisions by agents facing uncertainty in the absence of complete markets, give rise to a positive relationship between growth and inflation, for moderate levels of inflation.

On the other hand, Mallik and Chowdhury (2001) find empirical evidence of a positive relationship between both variables in the case of four countries in South Asia.

² See, for example, the work of Andrés and Hernando (1999), who conclude that there is a causal relationship, of a negative and statistically significant sign, of the inflation towards growth, which is robust to the exclusion of episodes of high inflation. of the conduct of macroeconomic policy in multiple countries. In fact, this position tends to be the central guide for the behavior of central banks in our region and is often accompanied by the explicit or implicit assumption that high and sustained economic growth requires as a necessary condition - and for some cases They seem to argue that it is also sufficient — a low and stable inflation.

In less stringent versions of this last position, it is affirmed that only when a certain threshold is exceeded does the inflation significantly and adversely affect the efficient allocation of resources, to the point of curbing investment and the pace of economic expansion (Sarel, 1995). If so, the threshold remains to be identified, in international comparisons, from which the greatest inflation reduces

Notes: the regression equation is: $GDP\ growth = 4.33 - 0.0210 * (inflation)$, where the inflation coefficient has a standard error of 0.0030, which implies a t-statistic of -7.3 . The coefficient of determination (R^2) of the linear regression is 0.0111, and the root of the mean square error is 1,2365. The sample includes 70 countries, based on real data in constant dollars and consumer price indices. Source: Own elaboration based on data from Ilzeki, Reinhart and Rogo ff (2008), Reinhart and Rogo ff (2010) and The Conference Board (2011).

⁴ For each country, the average of GDP growth and the inflation of consumer prices over the period 1950-2011 are calculated. The median is preferred as a measure of central tendency, since it is less sensitive than the average to the occurrence of extreme observations.

To delve into this, the graph also includes the result of the simple linear regression between both variables estimated by ordinary least squares. This line, in contrast, suggests a slight inverse correlation between inflation and growth medians, as well as a 1% increase in the median annual inflation associated with a 2.1% reduction in the median growth. Although this result is statistically significant, with a t-statistic value equal to 7.03, the regression adjustment is very poor, since the coefficient of determination (R^2) is only 1.13%, and does not pass the conventional tests of correct specification. In fact, both the axes of graph 1 and its scatter plot include box diagrams that formally account for the distribution of both variables. 5

These point out that the joint distribution, and the correlation, between both variables is influenced by the occurrence of extreme values.

Consequently, and in order to more systematically explore the hypothesis about the significance and direction of the relationship between inflation and economic growth, the sample was segmented with subgroups of economies, in some sense homogeneous as to the conduct of their monetary policy. In this regard, and although, both the objectives and the instruments of monetary policy have evolved, it should be asserted that throughout the period analyzed the central banks have oriented said policy to keep the inflation at the lowest possible level. In this effort, in general its action sought to provide a nominal anchor to meet the inflationary expectations. In the adoption of this strategy, the choice of the exchange rate regime is prominent (see, among others, White, 2013).

Figure 2 shows the evolution of the medians (of the selected sample of countries) of the annual growth of real GDP and of the inflation over the course of 1951-2010. First, there is an important change in the trend of both variables in the early 1970s, linked to the collapse of the Bretton Woods regime and the first oil shocks. In effect, the impact of these phenomena is reflected in a rise in the level of inflation, as well as a decrease in the pace of global economic activity; changes that marked the end of the so-called golden decades of economic performance. 5 The ends of the “solid rectangles” drawn on the vertical and horizontal axis show the 25th and 75th percentiles of the corresponding variable, while the inner line shows the median of the distribution.

On the other hand, the termination of the lines at each end of these boxes shows the adjacent values, calculated as 3/2 times the interquartile range. mine ranging from the first half of the 1950s to 1973. The graph also indicates a certain change in the relationship between inflation and the pace of economic activity. To what extent was the intensity or direction of the relationship between inflation and global economic growth significantly altered? It is part of the questions for which this work provides inputs for your response.

Source: own elaboration based on data from Ilze ki, Reinhart and Rogo ff (2008), Reinhart and Rogo ff (2010) and The Conference Board (2011).

6 The graph also shows that, in addition to the supply shocks produced in the 1970s following the oil embargo, the various crises of the last 30 years have influenced the evolution of inflation and economic growth, and probably also in their interaction.

The previous discussion reflects to some extent the restrictions inherent in what Fleming (1962) and Mundell (1963) called the “Impossible Trinity,” according to which a country can adopt at most two of the following three policies: 1) free mobility of capital in the balance of payments; 2) fixed nominal exchange rate, and 3) monetary autonomy, understood as the ability to set the nominal interest rate different from that which governs transactions in the international financial market. In fact, the evolution of the international financial regime can be periodized according to the weighting assigned to each of these three policies.

This section explores the nature of the relationship between inflation and growth using the taxonomy provided by the different combinations of policy provided regarding the exchange rate regime, the degree of opening of the capital account and monetary autonomy.

First, the relationship between both variables at an aggregate level is explored in depth, both for the global sample of countries and the subsample of Latin American countries, without any restriction on the range of the two variables considered.

Subsequently, the regression analysis is repeated but restricting the samples in order to successively exclude from it the observations whose inflation is extreme in the sense that it exceeds certain ranges. These ranges are gradually being reduced downwards in each round of estimation of the correlation coefficients from the panel data.

As mentioned, the extreme observations in the data panel skew the estimated correlation coefficients. An alternative to correct this bias is to perform the statistical analysis based on a transformation of the initial variables, which reduces the effect of the observations or extreme values. For the present study, the procedure of replacing the usual measurement of the annual inflation of the consumer price index (π) was adopted by its non-linear transformation that is usually identified as a measure of the inflationary tax [$\pi / (1 + \pi)$].

The result of the previous procedure is presented in Figure 3. The first element to highlight is that the proposed transformation attenuates the impact of extreme values on inflation. However, the regression coefficient linear suggests the persistence of a negative relationship between the variables, which is statistically significant, the regression adjustment is even worse than the one observed before performing the transformation. To refine the analysis, in the table 1 the results of the panel regressions are offered between the observations of the annual median GDP growth and the inflation tax, restricting the sample to different levels of inflation. The first line reports the results for the entire panel. The second reports the results when the sample is restricted to Latin American countries.

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Notes: the regression equation is: $\text{growth} = 4.30 - 0.0138 * (\text{inflationary tax})$, where the inflation coefficient has a standard error of 0.0025, which implies a t-statistic of -5.58 . The coefficient determination R^2 of the linear regression is 0.0071, and the root of the mean square error is 1.2391. The sample includes 70 countries, based on real data in constant dollars and consumer price indices. Source: Own elaboration based on data from Ilze ki, Reinhart and Rogo ff (2008), Reinhart and Rogo ff (2010) and The Conference Board (2011).

It is important to highlight the contrast with the regressions in Figures 1 and 3. In these, the median of each country throughout the period represents an observation, and the coefficients are estimated using ordinary least squares. In contrast, annual information and panel structure are exploited in Table 1, so that for each country and for each year there is an observation, and the coefficients are estimated using panel regressions.

Correlación entre impuesto inflacionario y crecimiento económico, 1951-2010 Rango impuesto inflacionario

Muestra		[-5,100]	[-5,80]	[-5,60]	[-5,40]
70 países	Coefficiente	-0.0786***	-	-	-
	0.0802***	-0.0782***	-0.0715***	-	-
	0.0578***				
	Probabilidad	0.00	0.00	0.00	0.00
	0.00				
América Latina	Coefficiente	-0.733***	-	-	-
	0.0736***	-0.0716***	-0.0739***	-	-
	0.0577***				
	Probabilidad	0.00	0.00	0.00	0.00
	0.00				
70 países		[-5,20]	[-5,10]	[-5,5]	[-5,3]
	Coefficiente	-0.0184			
	0.0435	0.1147	0.1091		
	Probabilidad	0.37	0.15	0.18	0.30
América Latina	Coefficiente	-0.0239	-	-	-
	0.0067	-0.1062	0.042		
	Probabilidad	0.52	0.94	0.54	0.87

Source: own elaboration based on data from Ilze ki, Reinhart and Rogo ff (2008), Reinhart and Rogo ff (2010) and The Conference Board (2011).

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As mentioned, the extreme observations in the data panel skew the estimated correlation coefficients. An alternative to correct this bias is to perform the statistical analysis based on a transformation of the initial variables, which reduces the effect of the observations or extreme values. For the present study, the procedure of replacing the usual measurement of the annual inflation of the consumer price index (π) was adopted by its non-linear transformation that is usually identified as a measure of the inflationary tax [$\pi / (1 + \pi)$].

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Note: the asterisks in the coefficients denote their statistical significance: *** 99%, ** 95%, * 90%. The figure below the coefficient indicates the probability with which, under the null hypothesis that the coefficient is equal to zero, the estimated coefficient value can be observed. The ranges in parentheses are about inflation.

Source: own elaboration based on data from Ilzeki, Reinhart and Rogo ff (2008), Reinhart and Rogo ff (2010) and The Conference Board (2011).

Consistent with the evidence shown in graphs 1 and 3, with the transformation of the inflation variable, both for the panel of 70 countries and for the subsample of Latin American countries, the results of the regressions confirm an inverse relationship (that is, a negative coefficient) between the inflationary tax and the statistically significant economic growth for the entire panel.

Table 1, from its second column, offers the result of the correlation coefficient and its significance when the sample is restricted to inflationary tax values to successively narrower ranges. This sequence is made by eliminating the observations that exceed the ceilings that are bounding down, starting with 100, until reaching 3 in the last column of the table,

7 For all cases the coefficients were estimated using both fixed and random effects; however, only the coefficient selected by the Hausman contrast (1978) is reported. The results of the model selection are not reported, but are available for consultation through the authors. in the infe block Source: own elaboration based on data from Ilze ki, Reinhart and Rogo ff (2008), Reinhart and Rogo ff (2010) and The Conference Board (2011).

The estimated correlation coefficients between the growth rate and the inflation tax for the entire panel appear in the upper block of table 2, discriminating according to the independence of the monetary policy; while the lower block offers the results using only data from Latin American countries. As in the previous case, the columns present the correlation coefficients and their significance in different ranges of the inflationary tax.

The first element that stands out is that, as mentioned, the inflation in countries without monetary autonomy is considerably less than that observed in the group with monetary autonomy, so it is not possible to estimate the correlation in the ranges More spacious. In addition, with the exception of the smallest range in Latin America, the coefficients are not significantly different from zero. In contrast, among countries with monetary autonomy it is confirmed the relationship described above, where both the magnitude of the coefficients and their significance are reduced to the extent that the in fl action range is restricted, pointing to the existence of a threshold of significance in the relationship between the two variables.

Note: the asterisks next to the coefficients denote the statistical significance: *** 99%, ** 95%, * 90% The figure below the coefficient indicates the probability with which, under the null hypothesis that the coefficient is zero, the estimated value obtained from the coefficient is observed. The ranges in parentheses are about inflation. Source: Own elaboration based on data from Ilze ki, Reinhart and Rogo ff (2008), Reinhart and Rogo ff (2010) and The Conference Board (2011).

Comparing the results of the complete panel with those of Latin America, it can be seen that the magnitude of the correlation coefficients between inflation and economic growth is greater in the entire panel.

At the same time, while in the full panel the relationship remains significant in the range of between -5 and 20 , this is not the case for Latin America. This result attracts attention, since historically inflation has been considered a topic of first importance in this region. One possible explanation is the presence of other factors that may be affecting the interaction between inflation and growth, but whose effect is not captured in this analysis.

Without prejudice to the strategies that imply the absence of monetary autonomy, it is of particular interest to study in detail the institutional arrangements in force among countries that have decided to maintain an independent monetary policy. In the vast majority of these cases, the main objective of independent monetary policy is the search for price stability. Although, as Reinhart and Reinhart (2003) argue, the solution to the so-called international finance trilemma does not necessarily imply the adoption of pure regimes. For mere exposure purposes, the sample of the panel of countries during the last forty years is classified according to three regimes that represent extremes in the scope of possible policies under the trilemma.

In the first regime a fixed nominal exchange rate is combined with a closed capital account. This situation was prevalent during the regime that Bretton Woods, in force from the end of World War II until 1971. The second regime is the polar case, where a floating exchange rate is adopted and free capital mobility is allowed, a situation that to a large extent, it has characterized the international financial system since the mid-1990s. Finally, it is considered a third regime, in which a floating exchange rate is maintained, but restrictions on the free entry and exit of capital are maintained. This situation, although rare today, characterized several countries in South America until the end of the 1990s.

To make this taxonomy operational, the classification of *de facto* exchange rate regimes of the International Monetary Fund (IMF) reported by Ilzetzki, Reinhart and Rogoff (2008) and the capital account opening index developed by Chinn and Ito are used (2008). In particular, both pure and managed float regimes are classified as a floating type.

while the opening index of Chinn and Ito (2008) is normalized so that their values are between 0 and 1 , which represent a fully closed and open capital account respectively, and is classified as open for those cases where the index is greater than 0.5 .

The relationship of economic growth and inflation, based on this taxonomy, is illustrated in Figure 5. The first element to highlight is the heterogeneity within the group of countries with monetary authority. In this group, the median growth has been relatively constant between 3.5 and 4 percent over the period, but the trajectories under different regimes have been quite different. On the other hand, for the three regimes there is a significant decrease in the median inflation, which began to be observed in the 1980s in countries with regime II, and is consolidated at a level lower than 10% per year in the other two regimes towards the end of the 1990s. However, the experience prior to the general decline in inflation is very different, which explains why with a median of 16.5% per year, the inflation under regime III is almost four times higher than 4.4% registered by the regime II countries.

Note: Regime I. Fixed exchange rate and closed capital account; Regime II. Flexible exchange rate and open capital account, and Regime III. Flexible exchange rate and closed capital account. Source: Own elaboration based on data from Ilzeki, Reinhart and Rogoff (2008), Reinhart and Rogoff (2010) and The Conference Board (2011).

One possible explanation is that, as mentioned, until the second half of the 1990s, a significant part of the countries under regime III are Latin American, several of which suffered episodes of very high inflation. Among them are the cases of Argentina, Brazil and Mexico during the 1980s.

The second feature that attracts attention is that there is no inverse correspondence between inflation and economic growth between different regimes of monetary autonomy. In fact, despite the relatively low level of inflation they had, the countries of regime II registered the lowest economic growth rate among countries with monetary autonomy. This may have to do with the volatility caused by the free mobility of capital.

Table 3 shows the correlation coefficients of the three groups. For the complete panel, it is observed that in the regimes with a closed capital account (I and III) a non-linear relationship is confirmed in which the magnitude and significance of the correlation between inflation and growth is reduced to the extent that they are excluded cases with higher levels of inflation. At the same time, and as noted above, the evidence indicates that this relationship is less intense for Latin American countries. It is notable that under regime II, where monetary autonomy is achieved through the combination of a flexible exchange rate and an open capital account, there seems to be no significant inverse relationship between inflation and economic growth.

The theoretical literature of the late 1960s argued in favor of monetary autonomy in an environment of flexible exchange rates, on the grounds that monetary policy would be able to respond adequately to heterogeneous shocks. The convenience of this regime was preached in the stabilization mechanism provided by the uncovered interest rate parity, according to which the arbitrage opportunities caused by differences in interest rates between countries would be eliminated by exchange rate adjustments.

Notwithstanding the foregoing, the volatility experienced since the end of the 1990s, as well as the empirical evidence indicating that the discounted interest rate parity is only observed over very long periods, has resulted to rethink the desirability of adopting extreme positions (corner solutions) to the trilemma of international finance. Hence, the attention of various countries in the adoption of intermediate, floating, but managed exchange rate regimes and capital flow management measures to ensure effective monetary autonomy is further understood. Correlation between inflation tax and economic growth according to monetary autonomy regime, 1970-2010

Panel 70 countries
 Sample Range [-5,100] [-5,80] [-5,60] [-5,40]
 Regime I Coefficient -0.0889 *** -0.0886 *** -0.0893 *** -0.0915 *** -0.0892 ***
 Probability 0.0000 0.0000 0.0000 0.0000 0.0040
 Regime II Coefficient..... -0.0834 * -0.074 ***
 Probability..... 0.0860 0.0030
 Regime III Coefficient... -0.0883 *** -0.0973 ***
 -0.1151 *** -0.1332 ***

Probability... 0.0000 0.0000 0.0000 0.0000
 [-5.20] [-5.10] [-5.5] [-5.3]
 Regime I Coefficient - 0.0481 0.0544 0.1344 0.2899
 Probability 0.3760 0.5180 0.6050 0.5050
 Regime II Coefficient -0.0597 -0.0347 -0.1477 -0.0509
 Probability 0.3270 0.6680 0.2550 0.8510
 Regime III Coefficient -0.1444 *** -0.2306 * -0.1772 -0.3246
 Probability 0.0000 0.540 0.3160 0.2630
 Latin America
 Sample [-5,100] [-5,80] [-5,60] [-5,40]
 Regime I Coefficient -0.0692 *** -0.0699 *** -0.0575 ** -0.0472 -0.0177
 Probability 0.0000 0.0000 0.0350 0.1290 0.6640
 Regime II Coefficient..... -0.0706 -0.016
 Probability 0.141 0.318
 Regime III Coefficient... -0.0669 *** -0.0711 *** -0.0842 *** -0.0974 **
 Probability... 0.0020 0.0010 0.0000 0.0150
 [-5.20] [-5.10] [-5.5] [-5.3]
 Regime I Coefficiency -0.0022 -0.1373 -0.0973...
 Probability 0.9860 0.4850 0.9090...
 Regime II Coefficiency -0.0884 -0.1321 -0.3166...
 Probability 0.473 0.449 0.559...
 Regime III Coefficiency -0.1148 * -0.189 1.008...
 Probability 0.0580 0.7260 0.5460...
 Note: the asterisks next to the coefficient denote their statistical significance: *** 99%, ** 95%, * 90% The figure below the coefficient indicates the probability with which, under the null hypothesis that the coefficient is zero, the estimated value in the regression is observed. The ranges in parentheses are about annual inflation.
 Regime I. Fixed exchange rate and closed capital account; Regime II. Flexible exchange rate and

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2De acuerdo con el ranking 2014 del Banco Mundial en millones de dólares, siguiendo el Método Atlas.