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Inflation Dynamics in Latin America and the Caribbean

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Abstract[1]

We perform a principal component analysis of the inflation dynamics in Latin America and the Caribbean to assess the recent surge in inflation across the region. The principal component accounts for 57% of the variation in inflation in the last 17 years, and it is highly correlated to the principal components of inflation of country groups outside the region, especially post-COVID-19. Global factors such as US inflation, commodity prices, and international shipping costs can account for at least one-third of the variation of the principal component. The analysis implies that external factors are major drivers of the surge in inflation in the region post-COVID-19 lockdowns.

JEL classification: E31
Keywords: Inflation, Principal component, COVID-19, Emerging economies

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1 Introduction

Inflationary pressures around the world, which were starting to materialize in 2021 as the COVID-19 pandemic was subsiding and demand was being reactivated, increased sharply in early 2022 with the Russian invasion of Ukraine and its impact on key global commodity prices, particularly the price of crude oil and fertilizers. In 2022, advanced and emerging economies experienced the highest inflation rates in the last two decades.

In this note, we assess which part of the current inflation in Latin America and the Caribbean countries is imported, i.e., which part comes from a factor common to the region and to the world. To answer this question we estimate the principal component of the rates of inflation of the countries in the region, and we look at the relevance of this component in explaining the overall volatility of inflation. Additionally, we identify underlying drivers of the principal component by studying its correlation with different external factors usually associated with inflation.

Our results show that the principal component alone accounts for 57% of the variation in inflation across countries in Latin America and the Caribbean in the last 17 years. It captures both the rise in inflation in the region during the Global Financial Crisis, in 2008-09, and the most recent surge in inflation, post-COVID-19. In addition, we show that this result is invariant to the monetary policy regime each country adopts and that the principal component of inflation in the region is highly correlated to the principal component of other country groups outside Latin America and the Caribbean, particularly post-COVID-19. Finally, the external factors we consider account for roughly one-third of the variation of the principal component. Together, these results point to the importance of global factors in accounting for the recent surge in inflation in the region.

2 Principal-Component Analysis

This section computes the principal component of the inflation series of 19 countries in Latin America and the Caribbean.[2] We analyze how well the principal component accounts for the variation in inflation in our sample, and whether it is related to regional or global factors.

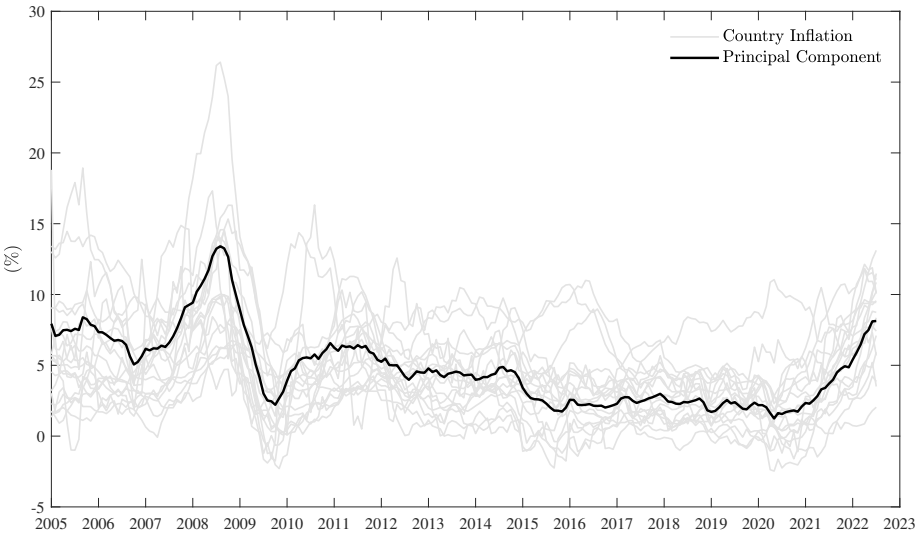
Our data set is a balanced panel containing monthly inflation series for a set of 19 countries in the region from January 2005 to July 2022, obtained from Haver Analytics and central banks. Each observation represents the 12-month percentage change in the country's consumer price index (CPI). We did not include the countries in the region with missing inflation data or those countries that reported annual inflation rates above 20% within our sample period. The reason for this is that having a balanced panel is necessary to compute the principal component, while high inflation episodes would bias its computation. Our panel comprises the following countries: The Bahamas, Brazil, Bolivia, Chile,

[2] We use the standard methodology found in Hotelling (1933).

Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, Trinidad and Tobago, and Uruguay.

Principal component (definition): The principal component is simply the linear combination of our 19 inflation series that explains most of the overall variation in inflation in our data. The exact linear combination is derived as follows. We take the variance-covariance matrix of our panel of inflation series, a 19x19 matrix, and compute its eigenvalues and eigenvectors. The eigenvectors are normalized such that the sum of their 19 elements is equal to one. The normalized eigenvector related to the largest eigenvalue is the linear combination of the inflation series that is used to compute the principal component. Let π_i denote the inflation series of country i and α_i the i^{th} element of the normalized eigenvector related to the largest eigenvalue. The principal component x can be defined as $x \equiv \sum_{i=1}^{19} \alpha_i \pi_i$.

Fig. 1. Inflation in Latin America and the Caribbean and Its Principal Component



Source: IDB staff calculations based on Haver Analytics data and Central Banks data.
Note: The sample includes 19 countries of the region: The Bahamas, Brazil, Bolivia, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, Trinidad and Tobago, and Uruguay. It is restricted by data availability from January 2005 until July 2022. Each gray line represents the inflation data of a country.

Figure 1 shows the principal component (black line) alongside the inflation series of the 19 countries in our sample (light-gray lines). Notice that the principal component captures the widespread increase in inflation around

2008-09, during the Global Financial Crisis, and in the most recent period, post-COVID-19. Moreover, the computation of the principal component allows us to immediately compute the share of the variance in inflation in our sample that the principal component accounts for. This share corresponds to the ratio of the largest eigenvalue over the sum of all eigenvalues of the variance-covariance matrix. In our case, the principal component alone accounts for 57% of the variation in inflation. In addition, if we compute the principal component for the sub-period post-March 2020, the beginning of the pandemic, it accounts for 83% of the variation. This is a strong indication that a common factor accounts for most of the inflation variation in our sample, particularly in the sub-period post-COVID-19.

Inflation across different monetary regimes

Next, we analyze how the inflation series differ according to the different monetary policy regimes each country adopts. We consider the following groups of countries: the five pioneers in adopting an inflation target regime (IT pioneers)–Brazil, Chile, Colombia, Mexico, and Peru, the countries that adopted an inflation target regime afterward (IT recent)–Costa Rica, Dominican Republic, Guatemala, Jamaica, Paraguay, and Uruguay, and the rest (Others)–The Bahamas, Bolivia, Ecuador, El Salvador, Guyana, Honduras, and Trinidad and Tobago. The latter comprises those countries with fixed exchange rates and those with dollarized economies, as well as countries that adopted a mixture of monetary policies. We then separately compute the principal component of the inflation series within each group.

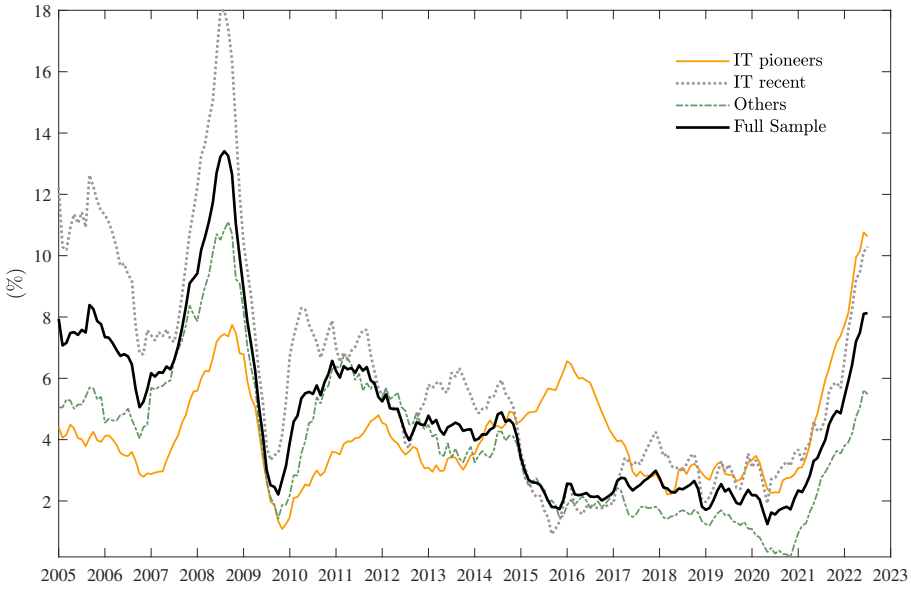
Figure 2 shows the principal component of each group together with the principal component that we computed above using all the Latin America and the Caribbean countries in our sample. It shows that the widespread increase in inflation in 2008-09 and post-COVID-19 did not depend on the monetary policy regime a particular country adopted at the time. For example, it could be argued that those countries with fixed exchange rates as well as dollarized economies imported global inflation during those episodes. Interestingly, however, the variations in inflation around those episodes were very similar across all the groups, particularly post-COVID-19. That is yet another strong indication that a common factor is driving the recent surge in inflation.

A global factor driving the recent surge in inflation in Latin America and the Caribbean

But is this common factor a regional or a global factor? To answer this question, we compare the principal component of the inflation series in the region to those computed for the G7 economies and for the group of countries included in EMBI but excluding the countries in Latin America and the Caribbean. They are illustrated in Figure 3.

Again, the principal components of each of the three country groups show a rise in inflation around the Global Financial Crisis, in 2008-09, and in the post-COVID-19 period. It is also remarkable how the Latin America and the Caribbean's principal component (black line) resembles the one for the G7

Fig. 2. Principal Component in Latin America and the Caribbean by Monetary Regime



Source: IDB staff calculations based on Haver Analytics and Central Banks data.
Note: "IT pioneers" includes Brazil, Chile, Colombia, Mexico, and Peru, "IT recent" includes Costa Rica, Dominican Republic, Guatemala, Jamaica, Paraguay, and Uruguay, and "Others" covers The Bahamas, Bolivia, Ecuador, El Salvador, Guyana, Honduras, and Trinidad and Tobago. "Full Sample" represents the principal component of the 19 countries.

economies (green line) after 2017. We interpret these patterns as evidence that the common factor driving the recent surge in inflation in the region is indeed a global factor.

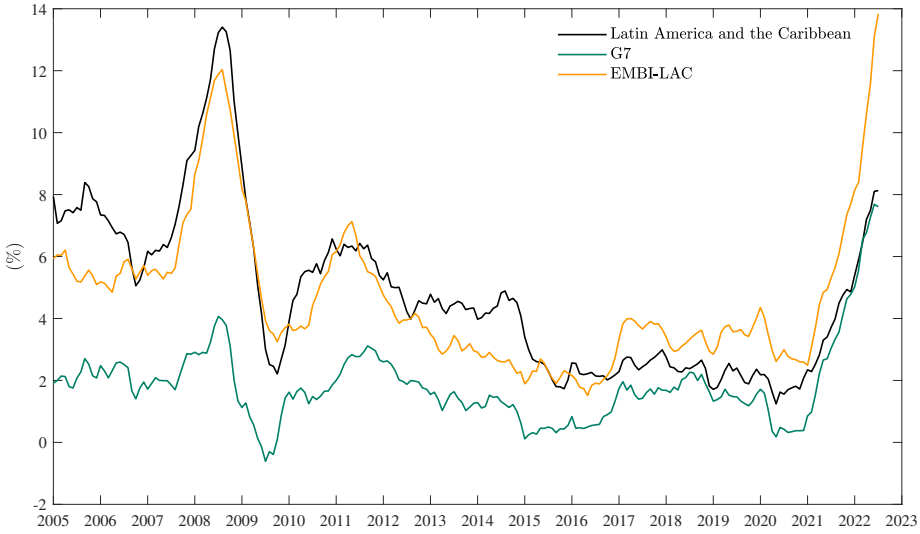
3 Determinants of the Global Factor

In the previous section, we concluded that a principal component explains most of the recent surge in inflation across the countries in Latin America and the Caribbean and that this principal component is in fact related to a global factor. In this section, we explore the potential determinants of this global factor. More specifically, we analyze whether it can be accounted for by US inflation, international commodity prices, or shipping costs using standard regression techniques. [3].

Data for US inflation are from the US Bureau of Labor and Statistics. For commodity prices, we use the IMF's Commodities Database. In particular, we

[3] Discussions on the role of global factors explaining inflation can be found in multiple places; a summary can be found in Ha et al. (2019). An analysis specifically for Latin America and the Caribbean countries can be found in De Gregorio et al. (2007) and Galindo and Nuguer (2023)

Fig. 3. Principal Component of Inflation for Different Countries



Source: IDB staff calculations based on Haver Analytics data and Central Banks data.
Notes: The principal component for Latin America and the Caribbean includes: The Bahamas, Brazil, Bolivia, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Panama, Paraguay, Peru, Trinidad and Tobago, and Uruguay. The principal component for EMBI countries excluding Latin America and the Caribbean consists of Armenia, China, Cote d'Ivoire, Croatia, Egypt, Georgia, Hungary, India, Indonesia, Kenya, Latvia, Lithuania, Malaysia, Namibia, Nigeria, Oman, Pakistan, Philippines, Poland, Romania, Russia, Senegal, Slovakia, South Africa, Tunisia, and Zambia. The advanced economies group (G7) is composed of Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

use the Commodity Price Index and three of its sub-indices: Agricultural Raw Materials, Fertilizers, and Fuels.[4] We also construct a measure of aggregated commodity prices by computing the principal component of the following IMF commodity price indexes: Food, Beverage, Agricultural Raw Materials, Base Metals, Precious Metals, Fertilizers, Crude Oil, Natural Gas, and Coal. Finally, we use the Baltic Dry Index as a proxy for international shipping costs.[5]

Table 1 reports the regression results. Columns 1 to 7 report the results for the simple OLS regressions in which we use each of the regressors separately. In column 8 we include the three commodity sub-indices in the regression, and in column 9 we add shipping costs to this group.

On the one hand, the price of fertilizers, column 4, is the one that shows the highest R^2 among the simple regressions (columns 1 to 7). Alone, the

[4] The relationship between commodity prices and inflation, particularly fuel commodities, has been amply studied. See, for example, Ha et al. (2019) Conflitti and Luciani (2019), Gelos and Ustyugova (2017), and Blanchard and Gali (2007), among others.

[5] The impact of shipping costs on commodities has been analyzed by, among others, Carrière-Swallow et al. (2022) and Guilloux-Nefussi and Rusticelli (2021).

price of fertilizers accounts for 25% of the variation in the principal component of inflation in Latin America and the Caribbean. This is consistent with the recent debate regarding the increase in the price of fertilizers due to the war in Ukraine and its implications for food and overall CPI inflation worldwide. US inflation, column 1, also accounts for a significant fraction of the variance of the principal component in our sample, roughly 20%.

On the other hand, our proxy for shipping costs, column 5, does not explain much of the variance of the principal component. That is somewhat surprising, given the ongoing discussions regarding the rise of shipping costs due to the supply bottlenecks still related to the COVID-19 crisis and its implications for global inflation. One must bear in mind, however, that the regression results reported in Table 1 include the whole sample period. It could be the case that shipping costs explain the current rise in inflation, but do a poor job of accounting for the fluctuations in inflation rates in the past, in the pre-pandemic period.

Moving to the specifications with multiple regressors, column 8 shows that the price of fertilizers accounts for most of the connection between commodity prices and inflation. That is, the R^2 of the regression barely changes once we add the prices of the two major commodity groups to the price of fertilizers. Finally, column 9 shows that the commodity price indices together with the shipping costs account for roughly one-third of the variation in the principal component in our sample.

Tab. 1. Understanding the Drivers of the Principal Component in Latin America and the Caribbean

Dependent variable: Main principal component	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
United States Inflation	0.661***									0.263
	(0.093)									(0.197)
Fuels		0.023***						-0.007	0.006	-0.002
		(0.004)						(0.006)	(0.007)	(0.009)
Agriculture			0.038***					0.019	0.019**	0.021*
			(0.011)					(0.012)	(0.011)	(0.011)
Fertilizers				0.031***				0.034***	0.028***	0.025***
				(0.004)				(0.006)	(0.006)	(0.006)
Shipping costs					-0.004*				-0.009***	-0.008***
					(0.002)				(0.002)	(0.002)
Commodity index						0.043***				
						(0.007)				
Commodities' principal component							0.020***			
							(0.004)			
Observations	211	211	211	211	211	211	211	211	211	211
R-Squared	0.196	0.136	0.055	0.255	0.016	0.166	0.132	0.264	0.328	0.333

Standard errors in parentheses. *** corresponds to $p < 0.01$, **, to $p < 0.05$, and *, to $p < 0.1$.
Note: Commodity index, Fuels, Agriculture and Fertilizers correspond to IMF indexes. Shipping costs are proxied with the Baltic Dry Index. Commodities' principal component is the main principal component of the following IMF indexes: Food, Beverages, Agriculture, Base Metals, Precious Metals, Fertilizers, Oil, Gas, and Coal.

Tab. 2. Correlation among the Different Indexes

	Commodities' principal component	Commodity index	Agriculture	Fertilizers	Fuels	United States inflation	Shipping costs
Commodities' principal component	1						
Commodity index	0.85	1					
Agriculture	0.70	0.87	1				
Fertilizers	0.86	0.71	0.63	1			
Fuels	0.92	0.96	0.76	0.75	1		
United States inflation	0.86	0.83	0.65	0.80	0.86	1	
Shipping costs	0.34	0.46	0.43	0.19	0.45	0.22	1

Note: Commodity index, Fuels, Agriculture and Fertilizers correspond to IMF indexes. Shipping costs are proxied with the Baltic Dry Index. Commodities' principal component is the main principal component of the following IMF indexes: Food, Beverages, Agriculture, Base Metals, Precious Metals, Fertilizers, Oil, Gas, and Coal.

When interpreting the results above, we need to keep in mind that these series are highly correlated with each other, so it is difficult to disentangle the exact contribution of each individual series in accounting for the variation of the principal component. We report the correlations in Table 2, which shows that in many cases they are larger than 0.8. It can also be the case that there is yet another global factor that we do not consider and that is explaining the fluctuations in these global price series. We can conclude, however, that the small group of international prices that we consider in Table 1 can account for a significant share–at least one third–of the variation in the principal component of inflation in Latin America and the Caribbean. This reinforces the case that global factors are driving the recent surge in inflation in the region.

4 Conclusion

Our analysis shows that the principal component of the inflation series in Latin America and the Caribbean accounts for 57% of the overall variation in inflation across countries in the region from January 2005 to July 2022, also capturing the recent widespread surge in inflation across the region. This result is consistent among different monetary policy regime groups, and we showed that the principal component of inflation in Latin America and the Caribbean is highly correlated to the principal component of other country groups outside the region, particularly the G7 countries in the past five years.

Moreover, we showed that US inflation, commodity prices, and shipping costs can account for a substantial share of the fluctuations in the principal component.

We conclude that global factors are major drivers of the recent surge in inflation in Latin America and the Caribbean.

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