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Is Inflation Domestic or Global? Evidence from Emerging Markets

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Is Inflation Domestic or Global? Evidence from Emerging Markets*

Rudolfs Bems† Francesca Caselli‡ Francesco Grigoli§ Bertrand Gruss¶
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Abstract

Following a period of disinflation during the 1990s and early 2000s, inflation in emerging markets has remained remarkably low. The volatility and persistence of inflation also fell considerably and remained low despite large swings in commodity prices, the global financial crisis, and periods of strong and sustained US dollar appreciation. A key question is whether this improved inflation performance is sustainable or rather reflects global disinflationary forces that could prove temporary. In this paper, we use a New-Keynesian Phillips curve framework and data for 19 large emerging market economies over 2004–18 to assess the contribution of domestic and global factors to domestic inflation dynamics. Our results suggest that longer-term inflation expectations, linked to domestic factors, were the main determinant of inflation. External factors played a considerably smaller role. The results underscore that although emerging markets are increasingly integrated into the global economy, policymakers remain largely in control of domestic inflation developments.

Keywords: Emerging markets, globalization, inflation, inflation expectations, Phillips Curve.

JEL Codes: E31, E58, F62.

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1 Introduction

There is a lively debate about the so-called "globalization of inflation hypothesis", that is whether globalization is responsible for a weakening in the relationship between inflation and domestic slack and a strengthening in the relationship between inflation and global factors (IMF, 2005b; Ball, 2006; Fisher, 2006; Kohn, 2006; Yellen, 2006; and Carney, 2017). The empirical evidence, which is limited to advanced economies, is mixed: Ihrig et al. (2010) find little support for an increasing role of global factors in the inflation process, and Borio and Filardo (2007) and Auer et al. (2017) argue that the role of global factors increased since the 1990s.[1] While most of the attention on the role of external factors in inflation dynamics focused on advanced economies—owing chiefly to the underwhelming reaction of prices to the global financial crisis and the subsequent wage puzzles[2]—this is a particularly relevant issue for understanding the recent macroeconomic performance of increasingly globalized emerging markets.

Following a period of disinflation during the 1990s and early 2000s, inflation in emerging markets has been, on average, remarkably low and stable (IMF, 2016a; and IMF, 2018). Even in the aftermath of large commodity price swings, the global financial crisis, and sizable appreciation of the US dollar, inflation in most countries was quick to stabilize, and the short-lived effects of inflationary shocks, in turn, allowed central banks to cut interest rates to fight off recessions. Was this due to improved macroeconomic frameworks that led to price stability or offsetting global forces? In other words, have the gains in inflation been well rooted through better domestic policies, or can they be expected to wane as global conditions shift?

Proponents on both sides of these questions can find evidence for their positions. The optimists can point to substantial supportive changes in institutional and policy frameworks (Rogoff et al., 2003; Vegh and Vuletin, 2014; and IMF, 2005a). For example, after the Asian crisis of the late 1990s, which illustrated anew some limitations of pegged exchange rate regimes, central banks in many emerging markets adopted inflation targeting. At the same time, many emerging markets introduced some type of fiscal rule. These policy changes, combined with the quick stabilization after large inflationary shocks, could indicate that the gains in inflation performance are well rooted.

Pessimists, on the other hand, can argue that opposing external forces might have contributed to inflation stability in emerging markets. China's integration into world trade and the broader globalization of commerce created a disinflationary environment benefiting emerging markets (Carney, 2017; and Auer et al., 2017). This, together with the effect of weak global demand in the aftermath of the global financial crisis, may have offset the inflationary effect of rising commodity prices and sustained appreciation of the US dollar. Moreover, the period following the global financial crisis was characterized by extraordinary benign external financial conditions—manifested in low US government bond yields and compressed spreads in emerging markets—that limited the number of crisis events and accompanying inflation surges (IMF, 2016b).

In this paper, we review the inflation performance in a sample of 19 large emerging markets over the past few decades and quantify the impact of domestic and global factors in determining in-

[1] The discussion of whether globalization has an impact on domestic inflation applies in the short to medium term, as in the long run the rate of inflation is set by monetary policy (Ihrig et al., 2010).

[2] See, for instance, IMF (2013), Danninger (2016), and Draghi (2017).

flation since the start of the post-disinflation period in the mid-2000s.[3, 4] To do so, we rely on a hybrid variant of the New-Keynesian Phillips curve that is augmented with foreign variables (similar to Borio and Filardo, 2007, Ihrig et al., 2010, and Auer et al., 2017 for advanced economies) and estimate the determinants of domestic core and headline inflation over 2004–18.

Our results show that longer-term inflation expectations are the main factor driving inflation from target and inflation variability. The findings also reveal significant cross-country heterogeneity, and that there is still significant room for improvement in inflation performance in some emerging markets from further reductions in the level and variability of longer-term inflation expectations. While some external factors, such as foreign price pressures, have a statistically significant impact on domestic inflation, they played a relatively small role in driving inflation dynamics in our sample. The reduced-form nature of the analysis carries some limitations, but several robustness tests confirm that the impact of global factors is marginal compared to that of domestic factors, and that inflation expectations reflect domestic developments.

These findings suggest that domestic rather than global factors were the main contributor to the gains in inflation performance among emerging markets since the mid-2000s. They underscore that that although these economies are increasingly interconnected with the global economy, their policymakers still have significant leverage on domestic inflation developments.

The rest of the paper is organized as follows. To set the stage, Section 2 discusses the globalization of inflation hypothesis and presents some stylized facts about the recent inflation performance in our sample of emerging markets. Section 3 presents the empirical analysis, starting with the estimation of the Phillips curve, moving to the quantification of the contributions of domestic and global factors, and concluding with a battery of robustness tests. Section 4 reports a few concluding remarks.

2 Background

This section first reviews the inflation performance for the 19 emerging markets in the sample. Then, it introduces the two main arguments that could help explain such performance: the globalization of inflation hypothesis, which relates the integration of emerging markets in the global economy with the price dynamics; and the adoption of rule-based policy frameworks (such as inflation targeting and fiscal rules), which are likely to have strengthened predictability in policy decisions and increased price stability.

2.1 Inflation Performance in Emerging Markets

Following a period of disinflation during the 1990s and early 2000s, inflation in emerging markets remained relatively low and stable. The left panel of Figure 1 shows that the weighted average of headline consumer price index (CPI) inflation (hereafter, headline inflation) for the 19 emerging markets in the sample declined dramatically—by more than a 100 percentage points from 1995

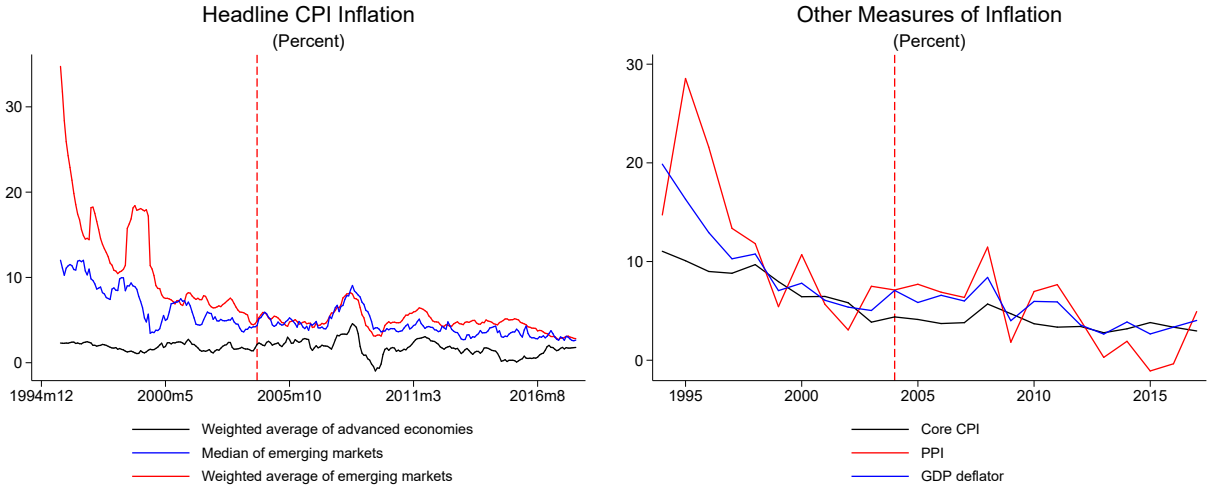
[3]The sample is defined by data availability of longer-term (that is, three-year-ahead and longer) forecasts for inflation and a minimum population of two million people. It includes the following countries: Argentina, Brazil, Bulgaria, Chile, China, Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, and Turkey.

[4]To the best of our knowledge, this is the first attempt to quantify the contribution of domestic and global factors to domestic inflation in emerging markets.

to 2004—and leveled off at about five percent thereafter, which is about three percentage points higher than the weighted average of advanced economies. Median headline inflation abstracts from the few hyperinflation episodes of the 1990s, but still shows a significant decline from about 20 percent to about five percent since 2004.[5]

Turning to other measures of price inflation, the inflation rate for core CPI (hereafter, core inflation), which exclude food and energy items with more volatile prices, also declined until the mid-2000s and remained low and stable thereafter, as shown in the right panel of Figure 1. The inflation rate of producer prices fell drastically during the 1990s and remained at relatively low levels ever since. Finally, GDP deflators, which encompass the prices of all domestically produced final goods and services, exhibit the same pattern.

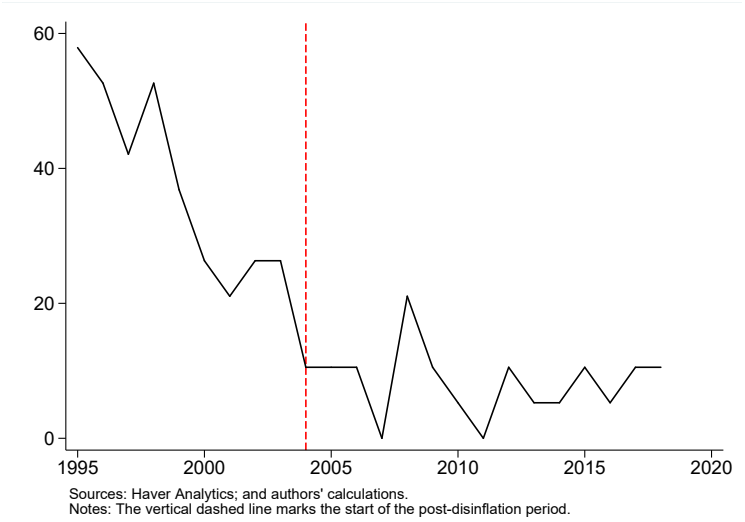
Figure 1: Disinflation in Emerging Markets
(Percent)



Sources: Haver Analytics; IMF, World Economic Outlook; and authors' calculations.
Notes: The vertical dashed line marks the start of the post-disinflation period. The vertical axis in the left panel is truncated at 25 percent to ease visualization.

[5]The 19 countries in the sample constitute 80 percent of the GDP of all emerging market and developing economies.

Figure 2: Share of Countries with Double-Digit Inflation
(Percent)



Sources: Haver Analytics; and authors' calculations.
Notes: The vertical dashed line marks the start of the post-disinflation period.

Despite this generalized decline in inflation rates across emerging markets, there is some heterogeneity. To illustrate this, Figure 2 shows the share of emerging markets in the sample with inflation rates exceeding 10 percent. In the late 1990s, about half of the countries in the sample experienced inflation rates above 10 percent. Since 2004, such share declined significantly, yet one country out of 10 emerging markets still experienced relatively high inflation rates.

Figure 3 shows that inflation volatility has been stable or declining in emerging markets since 2004. The decline in the volatility of inflation rates is not driven by exchange rate behavior, as there is no clear evidence of a decline in the volatility of exchange rate movements since the late 1990s.[6] Inflation persistence also declined gradually during the sample period, even though it remains somewhat above the level in advanced economies.[7] Two factors suggest that emerging markets could be expected to exhibit a greater degree of inflation volatility and persistence. First, a higher share of consumption in emerging markets is attributable to food and other commodities, whose prices tend to be more volatile. And, especially regarding persistence, monetary policy institutions and frameworks in emerging markets could be less developed and thus less effective.[8] So it is a notable commentary on the progress made in strengthening monetary policy frameworks in emerging markets that, since 2004, volatility in emerging markets has been comparable to that in advanced economies.

Both for volatility and persistence, however, the cross-country distributions indicate a variety of experiences. Either in the case of headline inflation or core inflation, the distribution for the latest observation covering 2016–2018 suggests that for 10 percent of the sample volatility and persis-

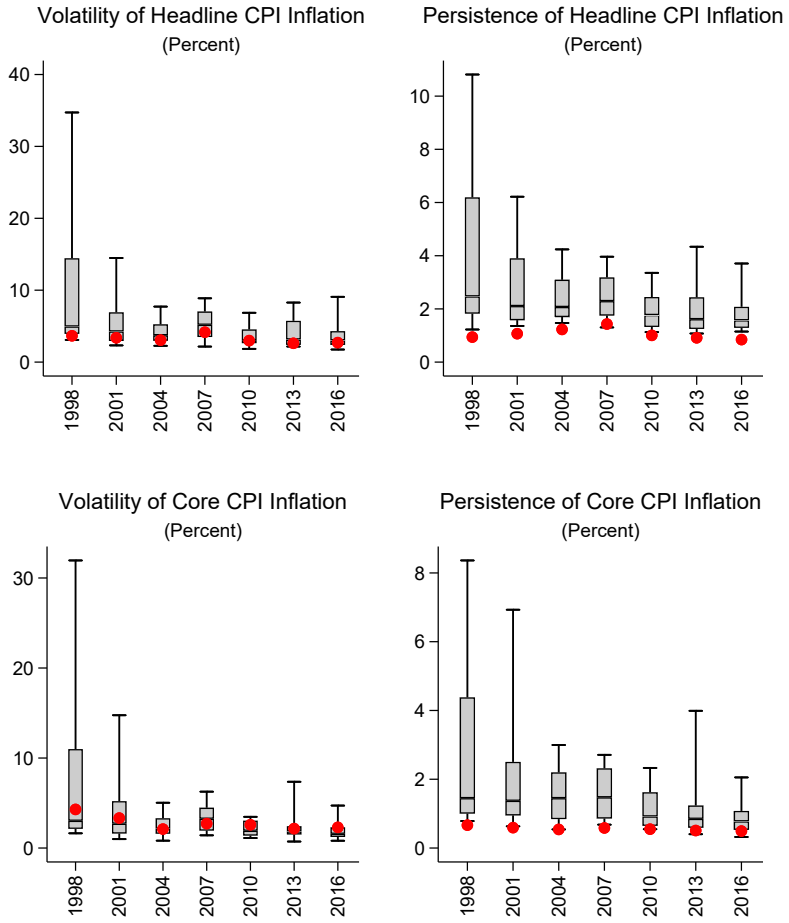
[6]See Ilzetzki et al. (2017) for a discussion of changes in *de facto* exchange rate volatility.

[7]Inflation persistence is defined as the tendency for price shocks to elevate inflation above its long-term level for a prolonged period. We calculate it following Stock and Watson (2007) and Stock and Watson (2010). The approach consists of decomposing inflation, π_t, into a permanent component, ζ_t, and a transitory component, η_t, where $\zeta_t = \zeta_{t-1} + \epsilon_t$ and η_t and ϵ_t are independently normally distributed with time-varying variances $\sigma^2_{\eta,t}$ and $\sigma^2_{\epsilon,t}$, respectively. The measure of inflation persistence underlying the calculations in Figure 3 is the estimated standard deviation of the shock to the permanent component of inflation.

[8]See Mishkin (2007) for a discussion of how better monetary policy can contribute to a decline in inflation persistence.

tence are about two to three times higher than for the median country. As for the level of inflation, we conclude that there is some cross-country heterogeneity with respect to the improvements in inflation volatility and persistence.

Figure 3: Inflation Dynamics



Sources: Haver Analytics; and authors' calculations.
Notes: The volatility is computed as the standard deviation of detrended inflation. Persistence is calculated as the standard deviation of the permanent component of inflation based on Stock and Watson (2007). The horizontal lines in each box denote the medians, the upper and the lower edges of each box show the top and bottom quartiles, the vertical lines denote the ranges between the top and bottom deciles, and the red dots denote the averages for advanced economies. The labels on the horizontal axis denote the start of the three-year windows.

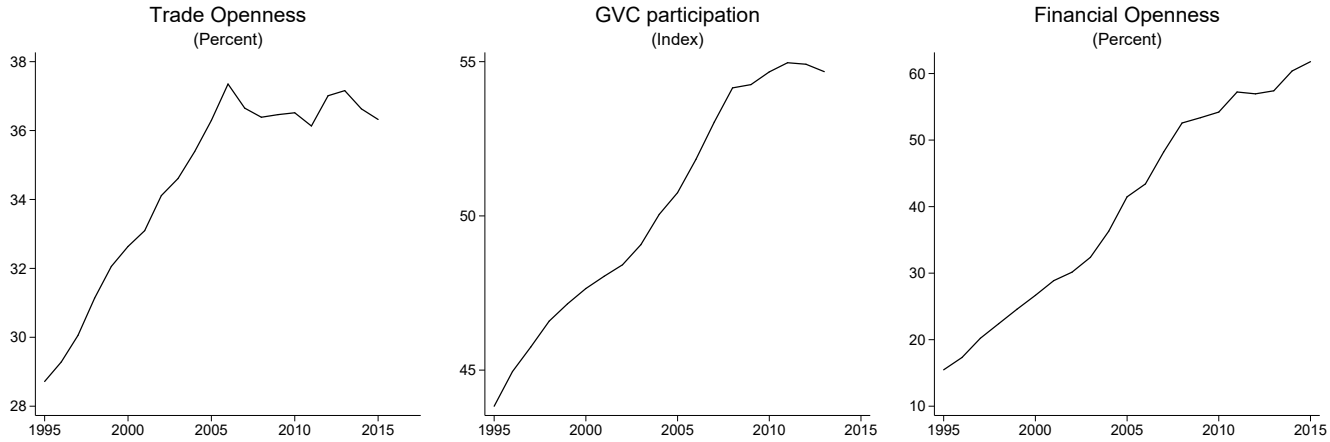
2.2 The Globalization of Inflation Hypothesis

The globalization of inflation hypothesis posits that, as economies deepen their level of integration in the global markets, competition takes a more global dimension, which likely puts downward pressure on prices. The possibility of outsourcing and offshoring increases the degree of substitutability of production stages. Thus, it might be economically convenient to relocate production where slack is large to enjoy lower costs, which in turn should be reflected in a stronger sensitivity

of prices to external conditions. If this is true, foreign factors become progressively more dominant in shaping inflation dynamics, and, in the words of Auer et al. (2017), the Phillips curve equation should take a more "global-centric" view of the inflation process, for example by including the foreign output gap (Borio and Filardo, 2007; Ihrig et al., 2010; and Auer et al., 2017).

In the past two decades the process of integration in emerging markets was remarkably intense. Figure 4 shows that trade openness increased steadily since 1995 for our sample of 19 countries and leveled off thereafter. The participation in global value chains (GVCs) also shows a marked increase over the past two decades, reflecting the intensification of outsourcing and offshoring of production.[9] The flip side of the increase in GVC participation is a deeper financial integration through foreign direct investment and portfolio investment. As a result, the average financial openness indicator for these economies displays a significant surge.

Figure 4: Integration of Emerging Markets into Global Markets



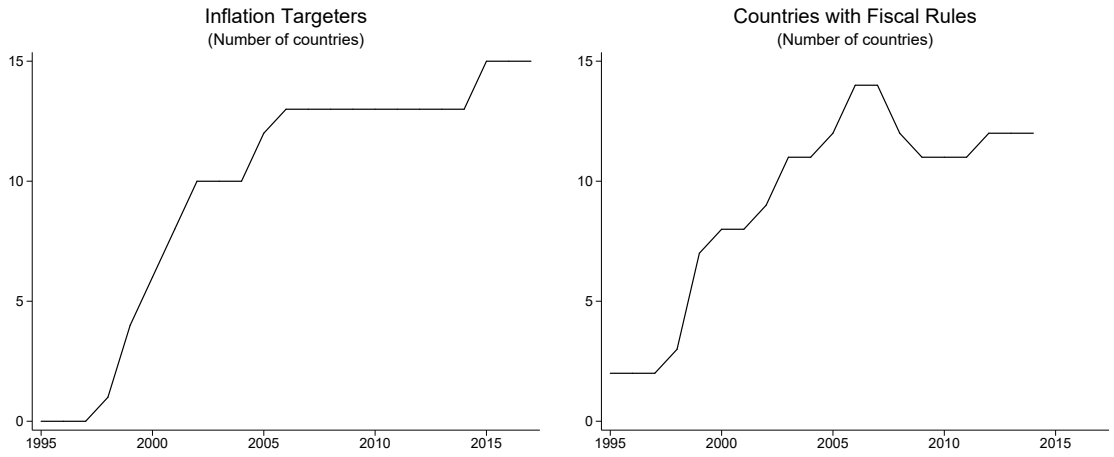
Sources: Aquib et al. (2017); IMF, Balance of Payments Statistics; IMF, World Economic Outlook; and authors' calculations.
Notes: Trade openness is defined as imports in percent of GDP, GVC participation is defined as sum of backward participation (imported intermediate inputs used to generate output for export) and forward participation (exports of intermediate goods used as inputs for the production of exports of other countries) as a ratio of gross exports, financial openness is defined as the sum of foreign direct investment and portfolio equity liabilities in percent of GDP. All variables are expressed as five-year moving averages.

2.3 Institutional Changes

Beyond greater integration, the last two decades witnessed important institutional changes in emerging markets, as shown in Figure 5. Out of the 19 countries in the sample, the number of inflation targeters increased from zero in 1995 to 15 in 2017. At the same time, the number of countries with some type of fiscal rule rose from 2 to 14 in 2007; by 2011, it fell to 11 as Argentina, India, and Russia suspended their fiscal rules, and rose again to 12 when Russia implemented a new fiscal rule in 2013. These institutional changes towards rule-based policy-making generally come with increased price stability and some predictability in policy decisions. If this is the case, the sensitivity of inflation to domestic factors may have increased.

[9]The GVC participation index is calculated as the sum of backward participation (imported intermediate inputs used to generate output for export) and forward participation (that is, exports of intermediate goods used as inputs for the production of exports of other countries) as a ratio of gross exports (see Aqib et al., 2017 for more details about the global value chain participation measure).

Figure 5: Adoption of Policy Frameworks



Sources: IMF, Balance of Payments Statistics; national authorities; and authors' calculations.
Notes: The number of countries with fiscal rules is the sum of the countries with any fiscal rule, as defined in the IMF Fiscal Rules Dataset (2016).

3 The Role of Domestic and Global Factors: An Empirical Assessment

The empirical analysis to uncover the role of domestic and foreign factors in determining inflation consists of two stages. The first stage estimates a Phillips curve augmented with variables proxying external factors for a panel of 19 emerging markets using quarterly data from the first quarter of 2004–the start of the post-disinflation period—to the first quarter of 2018.[10] After establishing the statistical significance of the inflation determinants, the second stage explores the contribution of domestic and foreign factors to inflation variation, across countries and over time. The section concludes by presenting a set of tests to ensure the robustness of the results.

3.1 An Augmented Phillips Curve Framework

3.1.1 Empirical Strategy

The analysis relies on a hybrid variant of a standard New-Keynesian Phillips curve (Galı and Gertler, 1999; Galı et al., 2001; and Galı et al., 2003). Drawing from the literature, the specification is augmented with variables that serve as proxies for macro developments abroad (Borio and Filardo, 2007; Ihrig et al., 2010; and Auer et al., 2017). Formally, we estimate the following equation:

$$\pi_{i,t} = \gamma^b \pi_{i,t-1} + \gamma^f \pi^e_{i,t} + \beta Y^{gap}_{i,t} + \theta Z^*_{i,t} + \eta_i + \epsilon_{i,t} \quad (1)$$

in which π is either core inflation or headline inflation; π^e denotes three-year-ahead inflation ex-

[10] The results are broadly unchanged if the start of the disinflation period is set to any quarter of 2004 or 2005.

pectations; Y^{gap} is the domestic output gap; Z^* is a vector of external variables that includes, depending on the specification, the import-weighted foreign output gap, an indicator for external price pressure in the previous period, and the lag of energy and food price inflation;[11] η_i denotes country fixed effects; ϵ is the error term; and i and t are the subindexes for the country and the time period, respectively.[12]

Inflation expectations, a key variable in the analysis, are from Consensus Economics and report the average of inflation forecasts across professional forecasters.[13] These forecasts are available biannually up to 2014 and at quarterly frequency thereafter. In the case of South Africa, the source is the Bureau for Economic Research, and data is available at quarterly frequency for the entire sample period. In all cases, inflation expectations are based on headline inflation forecasts, but it should be noted that the CPI definition may have changed over time.

Among the variables in vector Z^*, the foreign output gap is defined as:

$$\Delta Y_{i,t}^{*gap} = \sum_{j=1}^{J} \omega_{ij,t} Y_{j,t}^{gap} \tag{2}$$

where $i \neq j$, $\omega_{ij,t}$ is the share of exports from country j to country i in country i's total imports (lagged one year and measured annually), and $Y_{j,t}^{gap}$ is the Hodrick-Prescott filtered series of real GDP of country j.

The variable capturing external price pressures is defined as the percent change in the import-weighted producer price index of countries from which country i imports, converted to local currency using the nominal effective exchange rate, and relative to the percent change in the GDP deflator:[14]

$$\Delta P_{i,t}^{*} = \Delta mPPI_{i,t} + \Delta neer_{i,t} - \Delta P_{i,t} \tag{3}$$

in which $P_{i,t}$ is the natural logarithm of country i's GDP deflator. The change in the import-weighted foreign producer price index is given by:

$$\Delta mPPI_{i,t} = \sum_{j=1}^{J} \omega_{ij,t} \Delta PPI_{j,t} \tag{4}$$

where $i \neq j$, $PPI_{j,t}$ is the natural logarithm of country j's producer price index. And the change in the nominal effective exchange rate is constructed as the change in the bilateral exchange rate

[11] Differently from Borio and Filardo (2007), Ihrig et al. (2010), and Auer et al. (2017), we include the foreign output gap *and* external price pressure in the specification to capture both demand and supply shocks. Energy price inflation and food price inflation are not included in the specifications for core inflation.

[12] Despite the relatively high correlation between inflation expectations and past inflation, the variance inflation factor is well below 10 for all explanatory variables, ruling out multicollinearity concerns.

[13] The use of inflation forecasts collected through surveys covering professional forecasters is standard in the literature. However, some studies documented significant differences between forecasts of households and firms and those of professional analysts (see, for instance, Mankiw et al., 2003); unfortunately, however, surveys covering households and firms are rarely available.

[14] One may argue that, when pass-through from external to domestic prices is high, the external price pressure variable would understate the impact of external prices. While this is true, the pass-through within the same quarter to a broad measure of domestic prices such as the GDP deflator is likely to be limited.

of each trading partner vis-à-vis the US dollar, weighted by their import shares (Gopinath, 2015; and Carriere-Swallow et al., 2016):

$$\Delta neer_{i,t} = \sum_{j=1}^{J} \omega_{ij,t}(\Delta e_{i,t} - \Delta e_{j,t}) \tag{5}$$

where $i \neq j$, $e_{i,t}$ is the natural logarithm of country i's bilateral exchange rate (expressed in local currency per US dollar, so that an increase denotes a depreciation of the domestic currency); and Δ is the first difference operator.

We estimate the baseline specification employing median regressions to account for a few extreme observations. Alternatively, the analysis uses robust regressions, which downplay the influence of outliers, and constrained regressions that restrict the sum of the coefficients on past inflation and inflation expectations to be equal to one.[15]

3.1.2 Estimation Results

Table 1 presents the estimation results. Overall, the explanatory variables account for 52 percent (44 percent) of the variation of core (headline) inflation. The findings suggest that price setting was, to some extent, forward looking, with a coefficient on three-year-ahead inflation expectations ranging between 0.5 and 0.6 in the regressions for core inflation and 0.4 and 0.5 in the regressions for headline inflation.[16] Domestic cyclical conditions, for which the output gap serves as a proxy, also matter, but the size of the impact is small in economic terms: a one percentage point increase in the output gap is associated with an increase in the core headline inflation rate by 0.2 percentage points.

With respect to the external variables, the foreign output gap is not significant, even if the external price pressure variable is excluded from the specification. This is in contrast to the results of Borio and Filardo (2007) and Auer et al. (2017) for advanced economies, which find that foreign slack affects domstic inflation. External price developments, on the other hand, are an important determinant of inflation, as indicated by the positive and significant coefficient on the lag of external price pressure (food price inflation) in the regressions for core (headline) inflation. The effects, however, are economically small: a one percentage point increase in the external price pressure variable (food price inflation) is associated with an increase of 0.02 to 0.03 (0.01 to 0.02) percentage points in the core (headline) inflation rate.

3.2 Contributions to Inflation Deviations from "Target"

After establishing that both domestic and external factors play a role in determining inflation, we use the estimated panel coefficients to compute the country-specific contributions of the explanatory variables. Following Yellen (2015), we calculate the contributions to inflation in each quarter for each regression by taking into account the persistence of the inflation process:

[15] While potential endogeneity is a limitation for the estimation techniques used, the structure of the data (with gaps in the first part of the sample because inflation expectations are available at lower frequency) prevents the use of estimators that rely on lags, such as the generalized method of moments.

[16] Argentina does not have data for core inflation.

Table 1: Hybrid Phillips Curve Estimation, Specifications Augmented for External Factors

	(1)	(2)	(3)	(4)	(5)	(6)
	Core inflation			Headline inflation		
	Median regression	Robust regression	Constrained regression	Median regression	Robust regression	Constrained regression
Inflation expectations 3 years ahead	0.587***	0.631***	0.566***	0.396***	0.303***	0.564***
	(0.111)	(0.077)	(0.062)	(0.134)	(0.067)	(0.088)
Lag of core/headline inflation	0.494***	0.500***	0.434***	0.422***	0.481***	0.436***
	(0.037)	(0.023)	(0.062)	(0.047)	(0.028)	(0.088)
Output gap	0.159***	0.168***	0.103	0.188**	0.182***	0.110
	(0.045)	(0.037)	(0.070)	(0.086)	(0.067)	(0.095)
Lag of external price pressure	0.018***	0.018***	0.032***	0.005	-0.001	0.020
	(0.004)	(0.003)	(0.011)	(0.008)	(0.007)	(0.014)
Foreign output gap	0.021	0.060	0.070	0.117	0.085	0.169
	(0.050)	(0.053)	(0.100)	(0.087)	(0.103)	(0.130)
Lag of food price inflation				0.013***	0.018***	0.025***
				(0.004)	(0.004)	(0.006)
Lag of energy price inflation				0.000	-0.001	-0.001
				(0.002)	(0.002)	(0.003)
Countries	18	18	18	19	19	19
Observations	633	633	633	668	668	668
R-squared	0.525			0.445		

Source: Authors' calculations.
Notes: All specifications include country-fixed effects. Constrained regression force the sum of the coefficients on past inflation and expected inflation to be one. Robust regressions report the pseudo R-squared. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

$$C_{i,t}^{x} = C_{i,t-1}^{x}\gamma^{b} + (\varphi^{x} x_{i,t}) \tag{6}$$

where $C_{i,t}^{x}$ is the contribution to inflation dynamics in country i at period t of each explanatory variable x in vector $X = \left[\pi^{e}, Y^{Gap}, Z^{*}, \eta_{i}\right]$, γ^{b} is the coefficient on past inflation which captures the persistence of the inflation process, and φ^{x} is the coefficient on variable x. In other words, a dynamic simulation of the model is run by setting the initial value of each explanatory variable to zero and using the coefficient on lagged inflation to incorporate the effects of inflation persistence that are attributable to previous movements in the explanatory variables. To evaluate what factors contributed to average deviations of inflation from the target, the contribution of inflation expectations is re-expressed in terms of deviation from either an *explicit* target (the one announced under the inflation targeting regime) or an *implicit* one (the moving average of 10-year-ahead inflation expectations).[17]

Figure 6 shows the contribution of each factor to deviations of core inflation from target over four subperiods, which loosely correspond to the precrisis boom (from the first quarter of 2004 to the second quarter of 2008), the global financial crisis (from the third quarter of 2008 to the end of 2009), the postcrisis recovery (the start of 2010 to the second quarter of 2014), and the oil price decline and its aftermath (from the third quarter of 2014 to the first quarter of 2018).[18] The largest contributor to deviations of core inflation from target over the four subperiods is inflation expectations. That is, inflation expectations for the sampled emerging markets, on average, exceeded the

[17]Such decomposition can be performed under the assumption that the coefficients on the lag of inflation and inflation expectations sum to one. Both for median and robust regressions—in which the coefficients are unconstrained—Wald tests cannot reject the hypothesis of the sum of the coefficients being equal to one.

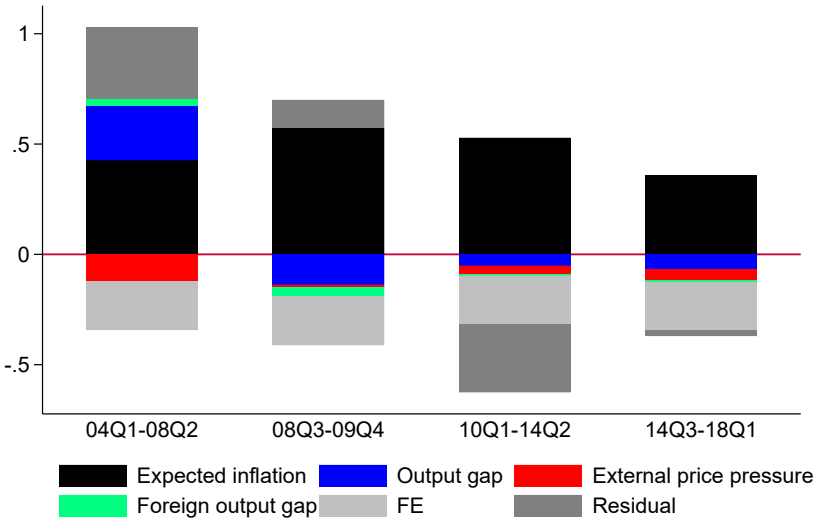
[18]We report the results for core inflation in the rest of the analysis to abstract from the volatility induced by energy and food prices and focus on the underlying inflationary pressures. However, the results for headline inflation are qualitatively similar to the ones for core inflation.

inflation target.[19] Domestic cyclical conditions played a smaller role. Upswings during the boom period led inflation to move above the target, while downturns during the global financial crisis led to lower inflation compared with the target.

Among the external factors, the largest contributor is the variable capturing external price pressures, which was, on average, deflationary during the sample period. However, the magnitude of this effect (-0.05 percentage point annually, on average, over the sample period) was considerably smaller than that of longer-term inflation expectations (0.5 percentage point). The deflationary pressure from external prices was most pronounced during the boom that preceded the global financial crisis.[20] The contribution of foreign slack is economically insignificant.

Figure 6 also shows that the overall deviation of inflation from the target declined gradually during 2004–14, by 0.7 percentage point. This trend is partly explained by output gaps (domestic and foreign), which stimulated inflation during the boom of 2004–07 and depressed it during the bust of 2008-09, and partly by the remaining residual.

Figure 6: Contributions to Deviation of Core Inflation from Target, by Subperiod
(Percentage points)



Source: Authors' calculations.
Notes: The bars represent the average contribution of each factor averaged across countries.

Could the decrease in the average decomposition residual during 2004–14 of Figure 6 signify a neglected common source of downward pressure on inflation? To address this question, the analysis estimates a common driver of inflation across emerging markets that cannot be explained by domestic factors. The approach is implemented in two steps. First, we include time fixed effects in a model specification as equation (1) but without the external variables in vector Z^*. Second,

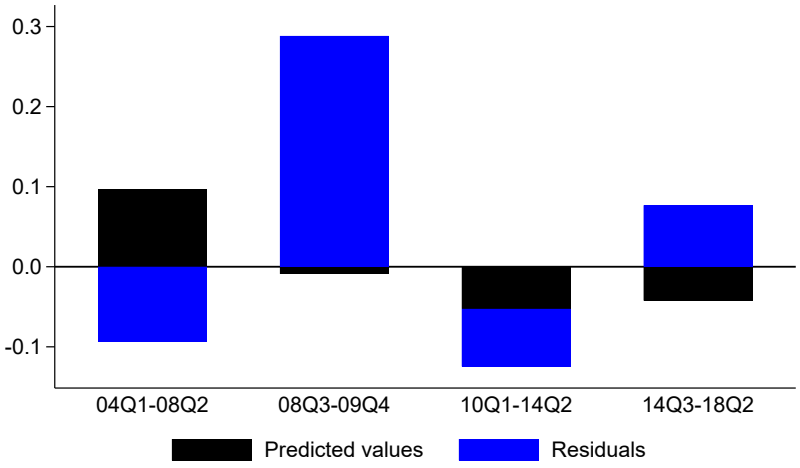
[19] This could reflect the public's doubts about the central bank's commitment to the inflation target or concerns about fiscal sustainability that may imply higher inflation in the future.

[20] Breaking up the contribution of the external price pressure variable into its subcomponents reveals that the contribution of the import-weighted nominal effective exchange rate—which in principle could also reflect domestic developments—is small, hovering around zero with the exception of the global financial crisis subperiod, when it reached 0.15 percentage points. The other two subcomponents, the import-weighted foreign PPI inflation and the percent change in the GDP deflator, present larger contributions ranging between 0 and 0.17 percentage points and -0.12 and -0.25 percentage points, respectively.

we regress the common component—that is, the time fixed effects—on the cross-country averages of the domestic determinants of core inflation, and obtain the predicted values and the residuals, which can be thought of the "true" residual of the first regression.

As shown in Figure 7, the common component (the sum of the predicted values and the residuals) captures the commodity-induced inflation surge during 2008, but for other sample subperiods its contribution to inflation deviations from target is small in economic terms. Furthermore, the estimated time fixed effects correlate with domestic explanatory variables, suggesting that the risk of neglecting other external forces is reduced. Beyond these factors, the residual provides a negligible average contribution to inflation during the post-global financial crisis period. These findings corroborate the earlier results on the comparatively limited average impact of global factors in driving inflation in emerging markets. Overall, the results of this section point to the centrality of fluctuations in longer-term inflation expectations in driving inflation in emerging countries, which are interpreted to be of domestic origin.

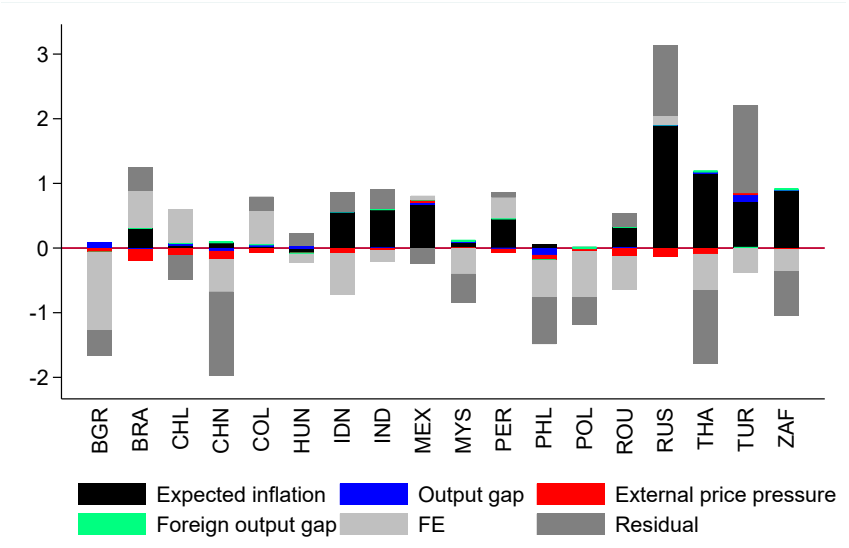
Figure 7: Common Driver of Core Inflation
(Percentage points)



Source: Authors' calculations.
Notes: Time fixed effects are based on a panel regression that excludes external variables. Residulas are from a regression of these time fixed effects on country averages of the domestic determinants of core inflation. Predicted values are displayed in terms of deviation from the mean over the sample period.

Examining the contributions at the country level reveals that although changes in longer-term inflation expectations are the main overall contributor to the deviations of actual inflation from target, there is noticeable cross-country heterogeneity. As shown in Figure 8, countries such as Chile and Poland, for example, show small contributions of inflation expectations from the target, consistent with the maturity of their monetary frameworks. On the other hand, in Russia and Thailand deviations of inflation expectations from target were large. Overall, the average inflationary impact of expectations is sizable for only half of the economies in the sample. In contrast, external price developments exerted downward pressure on domestic prices for three-fourths of the economies in the sample, even though the magnitude of this contribution is small. The impact of cyclical factors is by construction limited, when averaged over 2004-18.

Figure 8: Contributions to Deviations of Core Inflation from Target, by Country
(Percentage points)



Source: Authors' calculations.
Notes: The bars represent the average contribution of each factor averaged across periods.

3.3 Contributions to Inflation Variation

To assess what factors contributed to the *variation* of inflation, we perform an alternative decomposition. In the spirit of a variance decomposition exercise, we calculate the contribution for each variable x of vector X as:

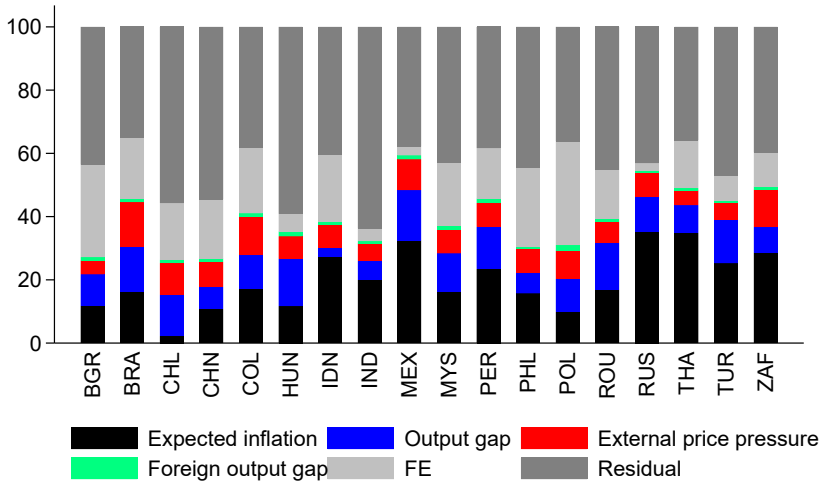
$$C_i^{var,x} = \frac{1/T \sum_t^T |C_{i,t}^x|}{\sum_x^X 1/T \sum_t^T |C_{i,t}^x|} \tag{7}$$

where the contribution of inflation expectations, C^{var,π^e}, is expressed in terms of deviations from the target. In words, the expression in equation (7) calculates the ratio of the average absolute value of the contribution of each variable to the sum of the same average absolute value of the contributions of all variables.

Figure 9 presents the contributions to the variation of inflation. The results confirm the importance of fluctuations in longer-term inflation expectations around the inflation target. Inflation expectations are the largest contributing explanatory factor for four-fifths of the sample countries, explaining, on average, 20 percent of the variation in inflation. Similar to the evidence in Figure 8, there is substantial heterogeneity across countries, with the share attributable to inflation expectations ranging from two percent to 35 percent. One should note that a low average contribution for a given factor over the entire sample does not mean it does not play an important role in driving inflation dynamics over the short term. For instance, Figure 9 shows that the share of inflation variation explained by inflation expectations was sizable in Colombia despite the very small average contribution reported in Figure 8, indicating that the contribution of fluctuations of inflation expectations around the target were relatively large but tended to cancel out along the sample.

With respect to the other variables, the results confirm that external price movements played a more limited role for variability in inflation rates, on average explaining eight percent of inflation deviations, and that the contribution of the foreign output gap is negligible in all decomposition results.

Figure 9: Contributions to Inflation Variation, by Country
(Percent)



Source: Authors' calculations.
Notes: The bars represent the average of the absolute values of the country-specific contributions over the period 2014Q1-2018Q1, as a percent of the overall deviation of core inflation from the target.

To establish the relative importance of domestic and foreign factors in determining the variation in inflation dynamics, we group the contributions into two subsets, S^n:

$$C_i^{var,S^n} = \sum_x^{S^n} \frac{1/T \sum_t^T |C_{i,t}^x|}{\sum_x^{S^n} 1/T \sum_t^T |C_{i,t}^x|} \tag{8}$$

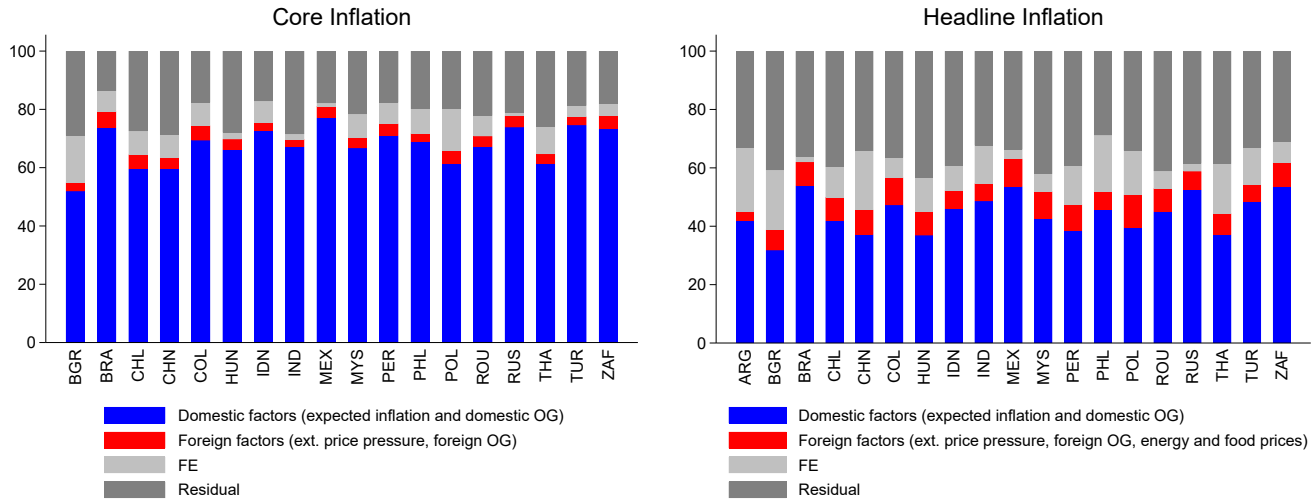
with $n = [1, 2]$ denoting a first subset consisting of domestic factors (inflation expectations and the output gap) and a second subset consisting of foreign factors (foreign output gap, external price pressure, and commodity price inflation).[21] The contribution of inflation expectations here is *not* expressed in terms of deviations from the target.

Applying this definition of global factors, the results shown in Figure 10 confirm that domestic

[21] The labeling of contributions as domestic and global factors warrants a cautionary note. On the one hand, inflation expectations can be affected by both domestic and global factors, leading to an underestimation of the contribution of global factors. However, the baseline specification directly controls for foreign variables. Moreover, the results when the inflation expectations variable is purged of external factors (by replacing it with the residual from a regression of inflation expectations on external price pressure, foreign output gap, and country and time fixed effects) are similar, indicating that inflation expectations are mostly driven by domestic factors. That said, foreign shocks that have an impact on the domestic output gap but are not captured by changes in the foreign output gap and the external price pressure variable can also lead to a downward bias in the estimated contribution of global factors. On the other hand, some of the fluctuations in the exchange rate embedded in the external price pressure variable can be due to domestic factors, potentially biasing the estimated contribution of foreign factors upward. Further tests can be found in Section 3.4.

contributions to inflation variation are much larger than foreign contributions, for both core inflation and headline inflation. Domestic contributions explain between 52 percent and 77 percent of core inflation dynamics and between 32 percent and 55 percent of headline inflation dynamics. The proportion of inflation dynamics explained by foreign factors is much smaller, ranging between three percent and five percent for core inflation and three percent and 11 percent for headline inflation.

Figure 10: Contribution of Domestic and Global Factors to Inflation Variation, by Country (Percent)



Source: Authors' calculations.
Notes: The bars represent the average of the absolute values of the country-specific contributions (accounting for persistence of inflation) over the period 2014Q1-2018Q2, as a percent of the sum of all contributions.

3.4 Robustness Exercises

The analysis in this paper is subject to some limitations. First, some variables categorized as domestic (foreign) could in reality contain foreign (domestic) elements; also, the results are subject to sizable uncertainty since 45 percent of the variation in inflation remains unexplained. Second, as in many other empirical exercise involving a Phillips curve estimation, the estimates can be affected by endogeneity arising from omitted variables. Third, three-years ahead inflation expectations might not be representative of long-term inflation expectations. In this section, we present the results of a series of robustness tests that provide some evidence to limit the concerns about these issues.

3.4.1 Global Factors

The baseline specification in equation (1) includes a vector of external variables, so the changes in inflation expectations should be orthogonal to changes in external factors. Still, one concern is that the evolution of inflation expectations may be capturing global developments that are common across countries. If one were to make the extreme assumption that all the residual is due to

uncaptured foreign factors, the average contribution of foreign factors to inflation variation would be 26 percent for core inflation and 44 percent for headline inflation, still less than or comparable to the average contribution of domestic factors (68 percent for core inflation and 44 percent for headline inflation).

In the alternative specifications of Columns (1) and (2) of Table 2, the vector of external variables is replaced with time fixed effects as catch-all variables for foreign factors. In this case, the average contribution of foreign factors to inflation would be 11 percent for both core and headline inflation. Time fixed effects, however, do not capture idiosyncratic movements in external price pressures, given that such pressures can vary by country. Therefore, in Columns (3) and (4) of Table 2, we add back the external price pressure variable to the specification that includes time fixed effects.[22] The results confirm that external price pressures remain significant despite the inclusion of time fixed effects, and that the average contribution of foreign factors to inflation variation would be 17 percent for core inflation and 14 percent for headline inflation.

As an additional robustness check, we run a regression of inflation expectations on foreign price pressure, foreign output gap, and country and time fixed effects. The coefficients on the external price pressure and the foreign output gap turn out marginally significant in this first stage. In a second stage, we modify the baseline specification to replace inflation expectations with the residual from the first stage, which is orthogonal to all foreign factors (and to domestic effects comoving over time and fixed across countries). The results are similar to the ones obtained in the baseline regressions, ensuring that inflation expectations are mostly driven by domestic factors.[23]

Finally, drawing on Choi et al. (2018), in the regression for headline inflation, we interact energy and food price inflation with the weight of these items in CPI baskets. The results in Column (5) of Table 2, the coefficient for food price inflation remains significant and becomes larger in magnitude, consistent with the large weight of food in the CPI baskets of the 19 sample countries, which averages 32.9 percent. The coefficient for energy inflation, however, is still insignificant, in line with its smaller weight in the CPI basket, which averages 9.6 percent. The results for other variables are virtually unchanged.

3.4.2 Extensions

As discussed in Section 2.2, the past few decades witnessed a trade integration process that led many emerging markets to participate more in GVCs. Deeper integration should be reflected in stronger competition from abroad, possibly affecting inflation dynamics. To capture the role of stronger trade integration that is not yet reflected in the external price pressure variable, the baseline specification is extended to include trade openness and participation in GVCs, as well as their interactions with external variables:

$$\pi_{i,t} = \gamma^b \pi_{i,t-1} + \gamma^f \pi^e_{i,t} + \beta Y^{gap}_{i,t} + \theta Z^*_{i,t} + \varphi T_{i,t} Z^*_{i,t} + \psi T_{i,t} + \eta_i + \epsilon_{i,t} \tag{9}$$

in which $T_{i,t}$ is a measure of trade openness or participation in GVCs. The results in Table 3 suggest there is no significant evidence that deeper trade integration has a significant effect on domestic inflation. As shown in Columns (1), (3), and (4), if anything, the coefficients on trade openness and GVC participation are positive when they are significant, but they are relatively small,

[22] The foreign output gap is not included in these specifications because it turns out to be insignificant in the baseline specifications.

[23] Results are available upon request.

Table 2: Hybrid Phillips Curve Estimation, Alternative Specifications

	(1) Core inflation	(2) Headline inflation	(3) Core inflation	(4) Headline inflation	(5) Headline inflation
	With time fixed effects	With time fixed effects	With time fixed effects	With time fixed effects	With weighted commodity inflation
Inflation expectations 3 years ahead	0.832***	0.327***	0.862***	0.353***	0.354***
	(0.111)	(0.082)	(0.104)	(0.080)	(0.102)
Lag of core/headline inflation	0.444***	0.488***	0.435***	0.490***	0.417***
	(0.039)	(0.036)	(0.040)	(0.033)	(0.045)
Output gap	0.172***	0.230***	0.138***	0.225***	0.167**
	(0.049)	(0.059)	(0.041)	(0.065)	(0.081)
Lag of external price pressure			0.016***	0.018***	0.006
			(0.003)	(0.005)	(0.008)
Foreign output gap					0.158**
					(0.076)
Lag of weighted food price inflation					0.045***
					(0.013)
Lag of weighted energy price inflation					0.016
					(0.018)
Countries	18	19	18	19	19
Observations	634	669	634	669	668
R-squared	0.561	0.494	0.568	0.498	0.445

Source: Authors' calculations.
Notes: The table presents median regression results. All specifications include country-fixed effects. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

and the results are not consistent across inflation measures. The interaction term between trade openness and foreign output gap in the specification for headline inflation is significant in Column (2), suggesting that movements in foreign cyclical conditions have an impact on inflation when the economy is more open, although the magnitude of the effect is small.

Since China joined the World Trade Organization in 2001, China quickly increased its share in global trade owing to relatively lower export prices and became an important trading partner for many emerging markets in the sample, possibly affecting their inflation dynamics. The analysis explores the role of price pressure from China by decomposing the external price pressure variable into its Chinese component and the non-Chinese component. The results in Columns (5) and (6) indicate that external price pressure from China does not have any significant impact on core or headline inflation dynamics, while non-Chinese external price pressures remain a significant determinant in the specification for core inflation, consistent with the results of the baseline specification.

3.4.3 Inflation Expectation Horizons

Inflation expectations in the baseline specification correspond to three-year-ahead inflation forecasts, a sufficiently long horizon to capture beliefs about inflation in the long term rather than the effect of transitory shocks and the response of monetary policy. However, to ensure that the results are not dependent on the selection of this specific horizon, we perform a series of robustness tests using inflation expectations of up to seven years ahead. The results in Table 4 for core in-

Table 3: Hybrid Phillips Curve Estimation, Extensions

	(1) Core inflation	(2) Headline inflation	(3) Core inflation	(4) Headline inflation	(5) Core inflation	(6) Headline inflation
	Interaction: Trade openness	Interaction: Trade openness	Interaction: GVC participation	Interaction: GVC participation	Interaction: China's external price pressure	Interaction: China's external price pressure
Inflation expectations 3 years ahead	0.643***	0.406***	0.632***	0.378***	0.551***	0.399***
	(0.100)	(0.107)	(0.096)	(0.121)	(0.096)	(0.104)
Lag of core/headline inflation	0.479***	0.422***	0.479***	0.427***	0.502***	0.426***
	(0.031)	(0.047)	(0.032)	(0.049)	(0.030)	(0.046)
Output gap	0.154***	0.223***	0.173***	0.194**	0.163***	0.206***
	(0.044)	(0.073)	(0.040)	(0.085)	(0.037)	(0.079)
Lag of external price pressure	0.009	0.011	-0.001	0.029		
	(0.008)	(0.016)	(0.014)	(0.036)		
Foreign output gap	-0.047	-0.195	0.038	-0.141	0.019	0.082
	(0.106)	(0.139)	(0.160)	(0.290)	(0.040)	(0.095)
Lag of food price inflation		0.014		0.020		0.012***
		(0.009)		(0.017)		(0.004)
Lag of energy price inflation		-0.002		-0.008		0.000
		(0.004)		(0.008)		(0.002)
Trade openness	0.015*	0.026				
	(0.008)	(0.020)				
Trade openness * lag of external price pressure	0.000	-0.000				
	(0.000)	(0.001)				
Trade openness * foreign output gap	0.002	0.007**				
	(0.003)	(0.003)				
Trade openness * lag of food price inflation		-0.000				
		(0.000)				
Trade openness * lag of energy price inflation		0.000				
		(0.000)				
GVC participation			0.060**	-0.033		
			(0.030)	(0.065)		
GVC participation * lag of external price pressure			0.000	-0.000		
			(0.000)	(0.001)		
GVC participation * foreign output gap			-0.001	0.004		
			(0.003)	(0.006)		
GVC participation * lag of food price inflation				-0.000		
				(0.000)		
GVC participation * lag of energy price inflation				0.000		
				(0.000)		
External price pressure excl. China					0.018***	0.007
					(0.003)	(0.007)
External price pressure from China					-0.004	-0.002
					(0.004)	(0.009)
Countries	18	19	18	19	18	19
Observations	624	659	633	668	627	662
R-squared	0.524	0.453	0.526	0.446	0.523	0.446

Source: Authors' calculations.
Notes: The table presents median regression results. All specifications include country-fixed effects. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

flation are robust to the change of the horizon for inflation expectations, with the magnitude of the coefficient decreasing only marginally as the horizon gets larger (the coefficient on expected inflation for horizons three to seven years ahead range from 0.56 to 0.64).[24] In the case of headline inflation, inflation expectations become insignificant for horizons of six years ahead and beyond, reflecting the higher volatility of headline inflation compared with core inflation.

[24] One potential concern with the Phillips curve specification is reverse causality from current inflation to inflation expectations, especially at shorter horizons. The decrease in estimated coefficients as the horizon lengthens is consistent with this concern. But the small magnitude of the differences suggests the effect is limited in economic terms.

Table 4: Hybrid Phillips Curve Estimation, Varying Inflation Expectation Horizon

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Core inflation				Headline inflation			
	4-year ahead infl. exp.	5-year ahead infl. exp.	6-year ahead infl. exp.	7-year ahead infl. exp.	4-year ahead infl. exp.	5-year ahead infl. exp.	6-year ahead infl. exp.	7-year ahead infl. exp.
Inflation expectations n years ahead	0.637***	0.614***	0.585***	0.560***	0.397**	0.448*	0.256	-0.066
	(0.125)	(0.130)	(0.131)	(0.155)	(0.158)	(0.245)	(0.262)	(0.247)
Lag of core/headline inflation	0.502***	0.524***	0.548***	0.549***	0.459***	0.461***	0.502***	0.537***
	(0.037)	(0.037)	(0.037)	(0.036)	(0.047)	(0.044)	(0.048)	(0.040)
Output gap	0.138***	0.136***	0.144***	0.168***	0.164*	0.152**	0.179**	0.172**
	(0.036)	(0.040)	(0.038)	(0.041)	(0.088)	(0.077)	(0.081)	(0.081)
Lag of external price pressure	0.021***	0.018***	0.020***	0.020***	0.008	0.004	0.008	0.003
	(0.003)	(0.003)	(0.004)	(0.003)	(0.009)	(0.008)	(0.009)	(0.008)
Foreign output gap	0.050	0.042	0.057	0.002	0.080	0.119	0.034	0.051
	(0.047)	(0.051)	(0.048)	(0.050)	(0.098)	(0.077)	(0.088)	(0.101)
Lag of food price inflation					0.013***	0.013***	0.013***	0.013***
					(0.004)	(0.004)	(0.005)	(0.005)
Lag of energy price inflation					0.000	0.000	-0.000	-0.000
					(0.002)	(0.002)	(0.002)	(0.002)
Countries	18	18	18	18	19	19	19	19
Observations	577	603	576	576	612	638	611	610
R-squared	0.514	0.519	0.513	0.511	0.446	0.439	0.442	0.443

Source: Authors' calculations.
Notes: The table presents median regression results. All specifications include country-fixed effects. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4 Conclusions

Following a period of disinflation during the 1990s and early 2000s, inflation in emerging markets has remained remarkably low and stable despite large swings in commodity prices, the global financial crisis, and periods of strong and sustained US dollar appreciation. A key question is whether this improved inflation performance is sustainable, or if it rather reflects a temporary constellation of global factors that put downward pressure on inflation. The literature on the role of global factors in driving domestic inflation focuses on advanced economies and presents mixed results.

This paper studies the role of domestic and global factors in driving inflation dynamics in emerging markets. We estimate a New-Keynesian Phillips curve model for core and headline inflation using data for 19 large emerging markets over 2004–18. Following recent contributions in the literature (Borio and Filardo, 2007; Ihrig et al., 2010; and Auer et al., 2017), we augment the model with variables capturing foreign macro developments, including the import-weighted output gap and producer price inflation of trading partners.

We find that domestic factors accounted for the lion's share of inflation dynamics in emerging markets. Fluctuations in longer-term inflation expectations, linked to domestic developments, were the main driver of average deviations of inflation from target and inflation variability. The contribution of global variables is not always statistically significant and, in any case, substantially smaller than the one from domestic factors in economic terms. While the analysis is subject to some caveats, several robustness tests confirm that the impact of global factors is marginal compared to that of domestic factors, and that inflation expectations reflect the evolution of domestic variables rather than global developments.

Our findings have important implications for monetary policy in emerging markets. They suggest that the gains in inflation performance since the mid-2000s are largely attributable to domestic factors. Thus, they underscore that although emerging markets are increasingly integrated with the global economy, inflation remains largely under the control of their policymakers.

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Appendix A. Data Sources

In table A.1, we report the data sources for all the variables entering the analysis.

Table A.1: Data sources

Variable	Source
Trade openness	IMF, World Economic Outlook
GVC participation index	Aqib et al. (2017)
Financial openness	IMF, Balance of Payments Statistics; IMF, World Economic Outlook
Inflation target	National authorities
Fiscal rules	IMF Fiscal Rules Dataset, 2016
Headline consumer price index	Haver Analytics
Core consumer price index	Haver Analytics
Producer price index	Haver Analytics
GDP deflator	IMF, World Economic Outlook
Domestic output gap	IMF, World Economic Outlook
Foreign output gap	IMF, Direction of Trade Statistics; IMF, World Economic Outlook
External price pressure	Haver Analytics; IMF, World Economic Outlook
Commodity prices (food and energy)	IMF, International Financial Statistics; national authorities