On the Credibility of Inflation Targeting Regimes in Latin America

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Abstract[1]

Inflation targeting has been adopted in a set of emerging economies, including eight countries in Latin America. The success of this regime may depend critically on the credibility of the target and the expectation that the authorities will take appropriate actions if the target is breached. This paper exploits a database of inflation expectations and attempts to measure whether, for a set of inflation targeters in Latin America, expectations are well anchored. A tighter anchoring of expectations is interpreted as a gain in credibility. Also considered are the effects on the credibility of the regime if the inflation target is breached. The results indicate that while inflation expectations have not been fully anchored over the whole sample period, credibility has risen, but at the same time the cost of breaching the target has grown.

Contents

List of Tables

List of Figures

3

1 Introduction and Motivation

Inflation targeting regimes have become popular around the world. Pioneers included the Reserve Bank of New Zealand in 1990, and in Latin America, Chile started to introduce the regime alongside an exchange rate band as early as 1991. Inflation targeting was subsequently adopted by many advanced economies such as Canada (1991), Israel (1992), the United Kingdom (1992), Sweden (1993) and Finland (1993). Several emerging economies have also adopted inflation targeting regimes including Israel, Korea, South Africa, the Philippines, and Thailand, and in Latin America, apart from Chile, Brazil, Colombia, Guatemala, Mexico, Paraguay, Peru and Uruguay.

Figure 1. Declining Inflation Rates in Latin America
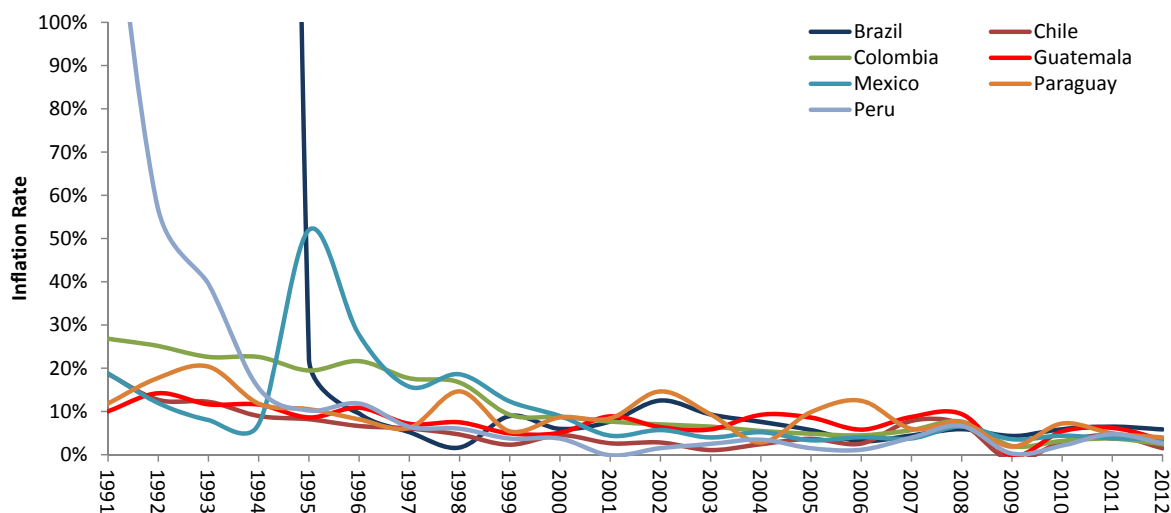
In Figure 1 we plot inflation rates for a selection of countries in the region. In the 1980s and early 1990s, several countries in Latin America suffered from extremely high rates of inflation. Monetary policy was largely dominated by fiscal needs, in several cases related to the fiscal consequences of the resolution of the 1980s financial crises and the lost decade in terms of growth that affected fiscal revenues. After several attempts at stabilization, inflation was eventually brought down. In some cases this was achieved through the use of a fixed exchange rate regime. However, inflation targeting was seen as an alternative to establish a nominal anchor without the potentially negative effects of a fixed exchange rate and to maintain some flexibility or a safety valve if abnormal conditions dictated straying from the targets. However, perhaps the main question was, given the region's previous poor inflation performance, whether such an anchor could gain credibility and, if so, how long that would take. We attempt to provide some evidence on that question in this paper.

Several papers argue that macroeconomic performance of inflation targeting countries is superior to that of countries that have adopted alternative regimes–Bernanke, Laubach, Mishkin, and Posen (1999), Corbo and Schmidt-Hebbel (2001), Corbo, Landerretche, and Schmidt-Hebbel (2001). In particular, Corbo and Schmidt-Hebbel (2001) compare the implementation and performance of inflation targeters around the world, including five countries in LAC, namely Brazil, Chile, Colombia, Mexico and Peru. They find that: i) most inflation targeters succeeded in bringing inflation down around the year of adoption of the regime, ii) they were successful in attaining their targets levels and ii) they exhibit sacrifice ratios and output volatility that are lower after the regime is implemented and comparable to those observed in developed countries. Schmidt-Hebbel and Werner (2002) also find that inflation and its associated output costs are lower in Brazil, Mexico and Chile relative to a control group of other countries without inflation targeting schemes. However, Mishkin and Schmidt-Hebbel (2001) also find that, although inflation targeting schemes are successful in helping countries reduce long-run inflation below the levels they would have attained otherwise, they do not yield inflation below the levels attained by industrial countries that have adopted other monetary regimes.

While these papers claim some evidence for the success of inflation targeting, they do not tackle the issue of credibility *per se*. Another strand of the literature has emphasized the importance of communication, transparency and strong institutions as a prerequisite for inflation targeting schemes to be successful.[2]

Our motivation is to consider whether there may have been gains in credibility over time. In Latin America, several central banks have adopted inflation targeting regimes and have developed a variety of means of communicating with the private sector. In this paper we exploit one such device, namely a survey regarding inflation expectations conducted regularly with private sector analysts that is published on a regular basis. More specifically, we consider the degree of sensitivity of changes in medium-term inflation expectations to shocks in actual inflation. If inflation expectations are well anchored, then medium term inflation expectations should not be highly sensitive to such shocks. In the first few years of an inflation targeting regime it might be considered likely that there would be reactions to inflation shocks but that over time, if credibility is gained,

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[2] See Demir and Yigit (2008). This is particularly relevant for emerging economies which, as noted by Fraga, Goldfajn, and Minella (2003), may face more pronounced external shocks, may have a weaker set of institutions and consequently may be expected to have less than full credibility. From a theoretical standpoint, problems of time inconsistency may prevent the development of credibility. For example, Calvo and Guidotti (1992) argued that issuing debt in dollars may be required to control countries' incentives to renege on the promise of price stability. One of the frequently advertised advantages of inflation targeting in this regard is the associated development of central bank independence (at least operational independence) and a communication strategy with the private sector through an inflation report, the published minutes of meetings or other means to provide greater information regarding the central bank's analysis of economic developments and likely policy measures, potentially contingent on different scenarios of the economy. It might be argued that credibility may be built up over time, assuming the consistency of such communications and of subsequent policy actions–see Mishkin and Schmidt-Hebbel (2001) for a related discussion.

then this sensitivity would be expected to decline. Our aim is thus to investigate whether this is true for the case of the inflation targeting regimes in Latin America.

The paper is organized as follows. In the next section we discuss the relationship between inflation and inflation expectations in inflation targeting regimes and in Latin America in particular. We then discuss in more detail the data we employ in the empirical analysis, Section 3. In Section 4 we investigate whether the inflation expectations revealed in surveys are biased. In Section 5 we describe the econometric methodology employed to consider if inflation expectations are well anchored in Latin America. Then, in Section 6 we consider how the effect of inflation being above the target might affect expectations. Finally, in Section 7 we examine whether the nature of the persistence has changed over time. Section 8 concludes.

2   Inflation Targeting and Inflation Expectations

Given indeterminacy in monetary models, expectations play a critical role. Questions such as whether expectations are rational or adaptive, and how quickly they react to policy measures, have created much debate in economics. But expectations are not directly observable, and indirect means of observation must be used. Long-run expectations, for example, can be derived from the difference in yields between nominal and inflation-indexed bonds. An alternative method employed by central banks to obtain inflation expectation estimates, particularly for the relatively short and medium-term, is through surveys of inflation expectations. Typically these surveys draw on the opinions of a targeted group of academics, consultants or private sector institutions (banks and other financial institutions) on a monthly basis.

The success of an inflation targeting scheme is in large part dependent on that regime maintaining a high degree of credibility. This in turn implies that inflation expectations must remain anchored and do not move excessively with each and every shock that may impact the economy and particular prices. One way to think about high credibility is that there must be an expectation that when shocks arrive, the authorities will take appropriate countervailing actions, for example, to keep inflation within the published targets. Interestingly, Gurkaynak, Levin, Marder, and Swanson (2007) find that while long-term forward nominal interest rates and inflation are "excessively" sensitive to releases of macroeconomic data, this is not the case in Canada and Chile, which have maintained explicit inflation targets. This is consistent with the hypothesis that inflation targeting may help to assist in anchoring expectations.[3]

In recent years, Latin American countries with inflation targeting regimes have been relatively successful in keeping inflation expectations close to published targets even when actual

[3] See also Gürkaynak, Levin, and Swanson (2010), van der Cruijsen and Demerizis (2011) and Pierdzioch and Rülke (2013).

6

inflation has deviated from those targets. Figure 2 plots monthly inflation expectations, each expectation being for the annual inflation rate of December of the following year (in green), monthly inter-annual inflation (in blue) and the inflation target (in red). In Chile, while inter-annual inflation reached 8.5 percent in April 2008, inflation expectations remained relatively stable at around 3.5 percent, indicating the expectation that inflation would come back to within the target. The same is true for most of the countries analyzed in this paper for the period considered. Exceptions include the case of Guatemala, where inflation expectations rose to levels somewhat higher than the target's upper band, and Uruguay, where actual inflation and inflation expectations have also risen above the target.

Figure 2. Current Inflation, Expectations and Targets in Latin America 2006 – 2012
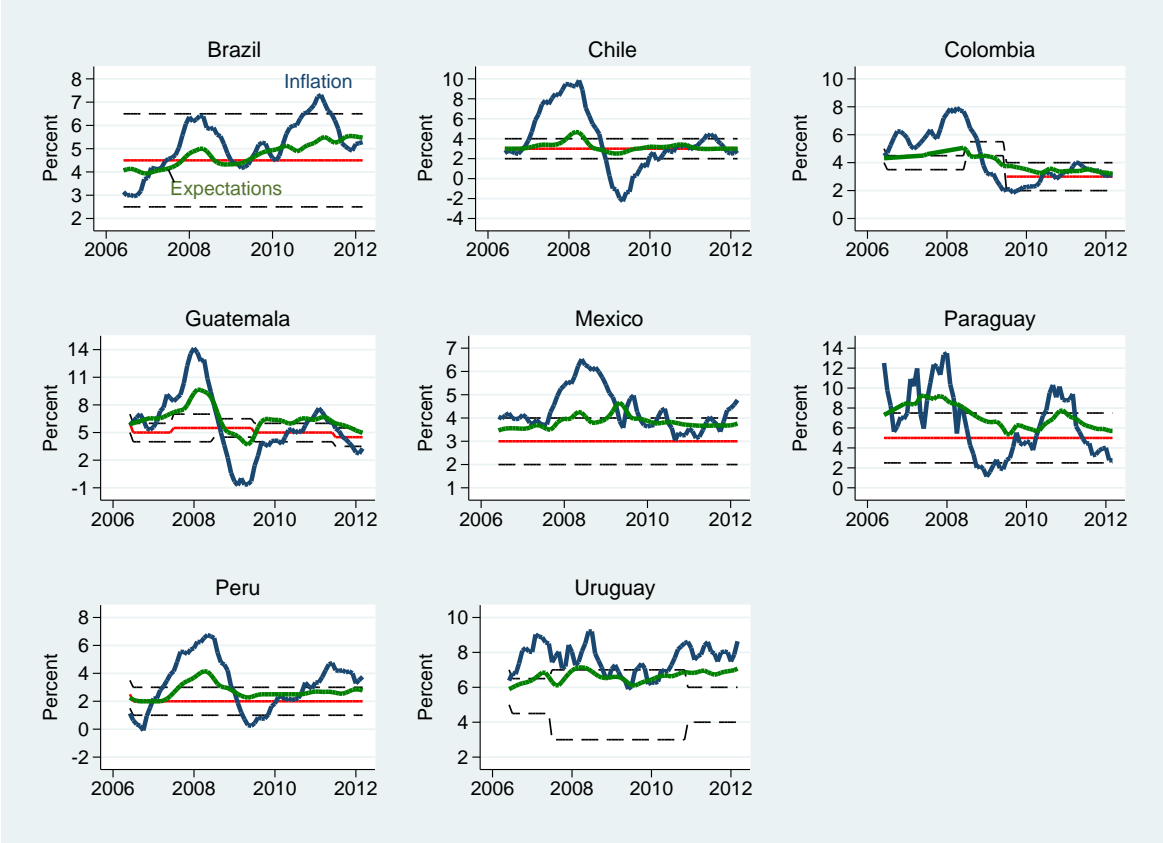
3 The Inflation and Inflation Expectations Data

The data on inflation expectations employed in this paper come from REVELA, an IDB database that compiles data on inflation and growth expectations from the central banks of Latin American countries that have inflation targeting schemes; the database is available at `www.iadb.org/revela`. The data are monthly and cover the period 2006-2012. The countries covered are Brazil, Chile, Colombia, Guatemala, Mexico, Paraguay, Peru and Uruguay. The data are downloaded on the third week of each month from the web pages of countries' central banks. REVELA collects mean inflation and mean growth expectations for all the countries for which that information is available. Most of these surveys are monthly, with the exceptions of Brazil and Colombia. Brazil maintains a daily database of expectations; in this case REVELA compiles the data for the 20th of each month, or the closest day when the data are available. Colombia's inflation survey is available monthly, but growth expectations (not used in this paper) are reported on a quarterly basis. Reported statistics differ among countries, but most of the central banks include means, which are typically compiled in REVELA. Chile and Peru only report medians, hence this is the statistic reported in those cases. Inflation figures are obtained from the relevant statistical agencies or central banks, and we match the inflation statistics with the expectations data.

4 Testing for Bias in Inflation Expectations

As the surveys on inflation expectations are under the control of the central banks that also maintain the very same inflation targeting regimes, there may be concern that there is a conflict of interest. It is interesting to note, however, as mentioned above, that at times these surveys have indicated expectations outside of the target bands. However, to consider whether the inflation surveys are reliable in a preliminary analysis we consider whether there is any bias in the surveys. Specifically, we estimate a regression of forecast errors using actual inflation data and inflation expectations data from REVELA on a constant. We use the inflation forecasts of March of every year for December of that same year (nine-month forecasts) for the period 2007-2011, and the forecast error is defined as the difference between the inflation expectation in March and inflation for that year, i.e. $E\left[\text{Inflation}_{\text{March t, Year t}}\right] - \text{Actual Inflation}_{\text{Year t}}$. Table 1 provides the results for the pooled regression across all countries across time. The constant is not statistically significant. This provides some evidence that there is no overall or systematic bias in the expectations. Of course, this does not mean that the expectations are necessarily good predictors of inflation. Indeed, there still could be significant errors in the forecasts for some countries or for some periods of time.[4]

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[4] Certainly, the graphs plotted in Figure 2 suggest that inflation expectations appeared to underestimate inflation in virtually all countries in 2007-2008. The food price shock, which was most likely unanticipated, pushed inflation higher in most countries during this period.

Indeed, in a second exercise we regress the forecast errors on a constant and country fixed effects. Here we do find some significant coefficients on some country dummies. Interestingly, we find the country fixed effect for Chile is negative while that for Peru is positive, and again the regression constant–which represents the dropped country, namely Brazil–is found to be statistically insignificant. Our interpretation of the results is that, while there may be forecast errors that may be significant in some cases or over some time periods, there is little evidence of a systematic bias in the inflation expectations data.

Table 1. Testing Bias in the Inflation Expectations

	Forecast Error
Constant	-0.122
	(0.34)
R^2	0.00
N	40

Note: A Regression of the Forecast Errors on a constant. Standard errors in parentheses.
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 2. Investigating the bias in inflation expectations

	Forecast Error
Chile	-0.044
	(0.03)
Colombia	0.588
	(0.41)
Guatemala	1.172
	(0.81)
Mexico	0.428
	(0.30)
Paraguay	2.692
	(1.87)
Peru	0.038
	(0.03)
Uruguay	-0.374
	(0.26)
Constant	-0.684
	(0.67)
R^2	0.17
N	40

Note: A regression with country fixed effects. Standard errors in parentheses.
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

5 Estimating the Credibility of Inflation-Targeting

In a credible inflation targeting regime, private analysts will anticipate the policy actions of central banks in attempting to address shocks to inflation that might threaten an inflation target. If inflation expectations are well anchored, changes in the actual inflation rate should have a low impact on medium-term inflation expectations and the system might be considered to have high credibility. This is the idea we follow in this paper to attempt to shed light on the credibility of inflation targeting regimes in Latin America and on whether such regimes have gained in credibility over time.

In terms of developing the econometric methodology, we are helped by Huang and Trehan (2008), who consider whether inflation expectations are well anchored in the United States. We adapt their methodology given the data we have available for several inflation targeting countries in the region. Following their approach we consider whether shocks to current inflation affect medium-term inflation expectations. Specifically, we employ inflation expectations two years out as we wish to avoid the automatic effect of a shock to inflation on the inflation rate for the current 12 months. We then estimate the following type of regressions:

$$E_t \pi_{t+i} = \alpha + \beta \, \pi_t + \gamma \, E_{t-1} \pi_{t+i} + \varepsilon_t \tag{1}$$

$$E_t \pi_{t+i} = \alpha + \beta \, \pi_t + \gamma \, E_{t-1} \pi_{t+i} + \delta \, Max \left[\pi_{t-1} - T_{t-1}, 1 \right] + \varepsilon_t \tag{2}$$

where π_t is the actual inflation rate in time period t and $E_t \pi_{t+i}$ is the t period expectation of inflation for time period $t + i$. T_t is the inflation target for country any given country. The breaching variable takes the value of inflation minus the target when inflation is at least 1 percent above the target. Our coeffficient of interest is β. The idea is then to consider whether, controlling for the previous period's medium-term inflation expectation, the new (current) inflation rate affects those expectations in the current time period. If inflation expectations are well anchored, then we would not expect to find a strong effect of current inflation on today's medium-term inflation expectations, and so the beta coefficient should not be quantitatively large or statistically significant. As discussed above, we use inflation expectations from the surveys conducted by central banks and employ expectations for inflation two years out.[5]

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[5] Huang and Trehan (2008) employ inflation expectations up to five years out, but such data are not typically available for countries in Latin America.

Individual Country Estimates

A first question is whether we can conduct a panel type analysis or whether we should conduct a set of separate country-by-country regressions as specified above. In Table 3 below we indicate a set of tests on the poolability across countries of the relevant slope coefficients including β, our parameter of interest. The conclusion is that in general we can reject that the slope coefficients are equal to each other and specifically that beta is the same across countries-see columns (1) and (2) of Table 3.[6] It appears that we should consider in the first instance country-by-country regressions.

Table 3. Poolability Tests

	Whole Sample		Aug 2008 - to End	
	(1)	(2)	(3)	(4)
Lagged Inflation	1.35	1.47	1.91	1.97
Expectations	(0.2263)	(0.1745)	(0.0672)	(0.0588)
Actual Inflation	2.99**	3.19**	0.89	0.91
	(0.0044)	(0.0027)	(0.5135)	(0.4991)
Lagged Relative Target		2.82**		0.66
		(0.0069)		(0.7049)
All Slopes	2.95***	2.55***	1.90*	1.50
	(0.0003)	(0.0002)	(0.0256)	(0.0742)

Note: F-test with p-values in parentheses. The null hypothesis of poolability test is homogeneity across countries.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

The results of country-by-country regressions for the whole sample are presented in Table 4 and Table 5.[7] The beta coefficient is positive and significant for all countries except for Mexico, where it is not significant at all, and Colombia, where it is only significant at the 10 percent level. However, for most countries the coefficient is relatively small, again in most cases an order of magnitude lower than the effect of lagged medium-term inflation expectations. The lowest coefficient, significant at the 5 percent level or higher, is found for the case of Chile (0.039); and the highest, for the case of Guatemala (0.17). This is perhaps to be expected, given that Chile is the oldest inflation targeter in the region and hence has had the longest period of time to establish credibility, while Guatemala is the most recent convert to this regime.

Indeed, it is likely that the credibility of inflation targeting regimes has changed over time. In particular, several of the regimes in Latin America are relatively new and hence it is possible that a track record of consistent communication and policy actions is required to build credibility

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[6] Column (2) includes a term comparing actual inflation to the level of the target. We refer to this and the other columns of this table further below.

[7] The regressions reported in Table 5 also include the term comparing actual inflation to the inflaiton target.

and to anchor expectations. This would imply that the coefficients above may not be stable over time. To investigate this possibility, we estimate the same regressions on a rolling moving time window. In Figures 3 and 4, we plot the beta coefficients for the rolling regressions, estimated on a 2.5 year rolling window, for each country over time. The beta coefficient tends to decline in all countries, although not always monotonically.[8] For example, in the cases of Colombia, Brazil and Paraguay there is some evidence (admittedly not always significant) that over some periods the beta coefficient actually rose. Uruguay is an excepitonal case where the beta coefficient does not appear to decline over time. Eyeballing Figure 2, which plotted actual inflation and inflation targets, the relevant periods appear to coincide with periods where inflation shocks were significant (for example, in Paraguay) or where inflation breached or appeared to be in danger of breaching the relevant inflation target (for example, in the case of Brazil and Colombia). In the cases of Chile and Mexico the beta coefficient was strictly not significantly different from zero for all the time windows considered, although as can be seen in the first window it was on the edge of significance for these two cases. It is also notable that the error bands on the beta coefficient for these two countries appear tighter than for the other cases, particularly compared to Brazil. At the end of the period, the beta coefficient is not significant for any country. These results indicate that in general inflation targeting regimes have indeed become more credible in Latin America, and by the end of the sample inflation expectations appear to be well anchored in all countries analyzed in these regressions.[9]

That said, there appears to have been some periods where medium-term inflation expectations did indeed respond to inflation shocks, and the graphs of particular countries suggest this is particularly likely to happen when the level of inflation is around or exceeds the target. This raises the interesting question of whether inflation targeting credibility suffers, in the sense that inflation expectations become less anchored, when the level of inflation rises and breaches the target. We investigate this in the following section.

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[8] Figure 3 plots the beta coefficient for similar rolling country by country regressions but with the breaching term added to the specification, we discuss this term below.

[9] Again Uruguay is an exception as the beta coefficient remains significant in the last time window.

Table 4. Country by country regressions of the effect of inflation shocks on expectations

	Brazil	Chile	Colombia	Guatemala	Mexico	Paraguay	Peru	Uruguay
Lagged Inflation Expectations	0.9417***	0.7886***	0.9178***	0.5900***	0.8954***	0.8108***	0.8175***	0.7763***
	(0.0352)	(0.0657)	(0.0397)	(0.0912)	(0.0958)	(0.0761)	(0.0586)	(0.0570)
Current Inflation	0.0454***	0.0388***	0.0319*	0.1713***	0.0396	0.0715***	0.0653***	0.0599**
	(0.0168)	(0.0107)	(0.0171)	(0.0339)	(0.0286)	(0.0264)	(0.0177)	(0.0244)
Constant	0.0815	0.5389***	0.1498	1.5990***	0.2617	0.8674*	0.3024**	1.0739***
	(0.1278)	(0.1825)	(0.1369)	(0.4372)	(0.3582)	(0.4499)	(0.1203)	(0.3516)
N	63	63	41	58	63	55	63	63
Adj.R2	0.9587	0.8949	0.9439	0.8966	0.6123	0.8444	0.9216	0.8020

Note: Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table 5. Country by country regressions of the effect of inflation shocks on expectations (with breaching target)

	Brazil	Chile	Colombia	Guatemala	Mexico	Paraguay	Peru	Uruguay
Lagged Inflation Expectations	0.9412***	0.7579***	0.9180***	0.5468***	0.8918***	0.8348***	0.7707***	0.7893***
	(0.0348)	(0.0711)	(0.0409)	(0.0933)	(0.1036)	(0.0884)	(0.0744)	(0.0634)
Current Inflation	0.0711***	0.0283*	0.0318*	0.1406***	0.0324	0.0843**	0.0511**	0.0716**
	(0.0234)	(0.0142)	(0.0175)	(0.0381)	(0.0792)	(0.0355)	(0.0225)	(0.0346)
Lagged Relative Target	-0.0696	0.0264	0.2237	0.0926	0.0098	-0.0335	0.0466	-0.0199
	(0.0447)	(0.0236)	(7.2723)	(0.0554)	(0.1004)	(0.0615)	(0.0457)	(0.0414)
Constant	-0.0284	0.6487***	0.1492	1.9449***	0.3017	0.6732	0.4342**	0.9285*
	(0.1447)	(0.2069)	(0.1401)	(0.4773)	(0.5478)	(0.5763)	(0.1765)	(0.4652)
N	63	63	41	58	63	55	63	63
Adj.R2	0.9597	0.8954	0.9424	0.8999	0.6058	0.8422	0.9217	0.7994

Note: Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Figure 3. **The effect of inflation on medium term inflation expectations by country (beta coefficients)**

Figure 4. **The effect of inflation on medium term inflation expectations by country with breaching target (beta coefficients)**
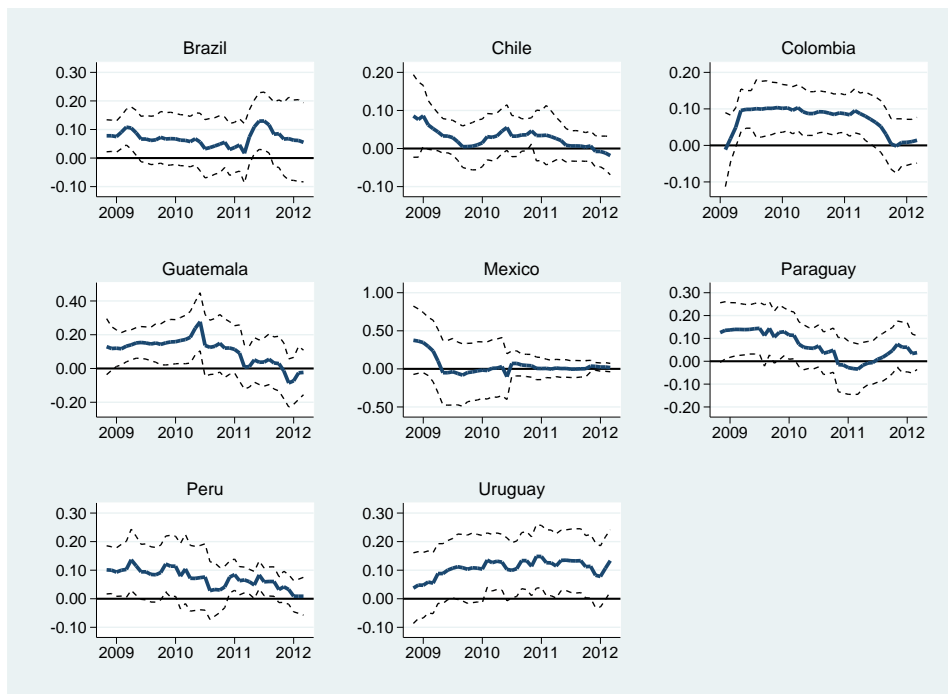
6 Inflation Credibility and the Inflation Target

In this section we consider how the effect of inflation being above the target might affect how well inflation expectations are anchored.[10] Specifically, we estimate the following two equations:

$$E_{t,k}\,\pi_{t+i,k} = \alpha_k + \beta\,\pi_{t,k} + \gamma\,E_{t-1,k}\,\pi_{t+i,k} + \varepsilon_{t,k} \tag{3}$$

$$E_{t,k}\,\pi_{t+i,k} = \alpha_k + \beta\,\pi_{t,k} + \gamma\,E_{t-1,k}\,\pi_{t+i,k} + \delta\,Max\left[\pi_{t-1,k} - T_{t-1,k}, 1\right] + \varepsilon_{t,k} \tag{4}$$

The first is simply the panel analog of the country-by-country regressions estimated above, although we aware that pooling may continue to be an issue - we come back to this below. In the second regression we add a further term in which $T_{t,k}$ is the inflation target for country k. This extra term then takes the value of inflation minus the target when inflation is at least 1 percent above the target or 1 otherwise. This allows us then to exploit the information available on the targets and actual inflation rates to consider whether, when inflation is above the target, this affects inflation expectations over and above the effect of current inflation shocks and controlling for the previous period inflation expectation. We choose 1 percent over the band to avoid those cases where inflation is just decimals over the target.

Table 6 presents the estimated coefficients for the whole sample that we have available: 2006-2012. The results on the simple panel regression are consistent with our previous country-by-country regressions. Two points stand out. First, inflation expectations appear to be highly persistent, with a coefficient on the previous period's medium-term inflation expectation of just over 0.8.[11] Second, the current inflation rate does indeed appear to have a statistically significant impact on medium-term inflation expectations. The coefficient is fairly small however, some 0.07, and so an order of magnitude less than the effect of lagged inflation expectations, implying a relatively small but statistically significant effect. Finally, turning to the second regression we do not find an overall additional impact when inflation breaches the relevant target.[12] In other words, over the whole sample, while we do find an impact of current inflation on medium-term inflation expectations, we do not find that inflation exceeding the band has an additional impact on how well expectations have been anchored, at least over the whole period.

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[10] The target is either the actual target when defined, or the mid-point of the band

[11] In a separate analysis not reported here we established that inflation and inflation expectations are I(0) over the sample period.

[12] As mentioned above, Uruguay is something of a special case, still these results are robust to including or excluding Uruguay.

Table 6. The effect of inflation shocks on inflation expectations

	Whole Sample		Jan 2010 - to End	
	(1)	(2)	(1)	(2)
Lagged Inflation Expectations	0.8164***	0.8140***	0.6864***	0.6336***
	(0.0458)	(0.0552)	(0.0785)	(0.1106)
Current Inflation	0.0705**	0.0683***	0.0628*	0.0191
	(0.0238)	(0.0176)	(0.0318)	(0.0203)
Lagged Relative Target		0.0053		0.1312***
		(0.0246)		(0.0297)
Constant	0.5015***	0.5177**	1.1099***	1.4790**
	(0.1033)	(0.1696)	(0.2163)	(0.4004)
N	406	406	210	210
Adj.R2	0.8737	0.8734	0.6769	0.6978

*Note*: Regressions on Inflation Expectations. Standard errors in parentheses.

* p<0.10, ** p<0.05, *** p<0.01.

However, as our country-by-country regressions appeared to change over time, we also decided to investigate how these results may change if we estimated the regression over different time windows. Figure 4 depicts the coefficient β-the impact of current inflation on medium-term inflation expectations from rolling country-by-country regressions. Figure 5 below presents the same for rolling panel estimates, both have a moving window of two-and-a-half years. The figures show that the impact of current inflation on expectations has steadily declined over time in most countries and for the pooled estimation. Indeed, as illustrated by the statistical error bands of Figure 5, in the last few periods the beta coefficient is not significantly different from zero at the 95 percent level, indicating that an inflation shock has no discernible effect on inflation expectations in this last 2.5-year window. Again, this is consistent with the country-by-country results presented above, where we found that in the last period the effect of inflation on medium-term inflation expectations was not significantly different from zero for each country with the exception of Uruguay.

However, as illustrated in Figure 6, we do find that coefficient δ–the effect of the relation between inflation and the target–also changes over the sample. In particular, we find that at the end of the sample this coefficient is positive and significant at the 5 percent level. This coincides with some data points where inflation does indeed exceed the inflation target. So considering the final sample estimations, the results imply that while in general medium term inflation expectations are not affected by current inflation, this is not true if inflation is above target. In that case inflation expectations may well be affected by the inflation rate relative to the target. Finally, we reconsider the pooling tests using the sample of these final estimates. Here we find that pooling among

countries is accepted. The results we presented in columns 3 and 4 of Table 3. Moreover, we present the rolling test for the β coefficient in Figure 7.[13]

Figure 5. Rolling Regression of the Effect of Current Inflation on Expectations (Beta coefficient)
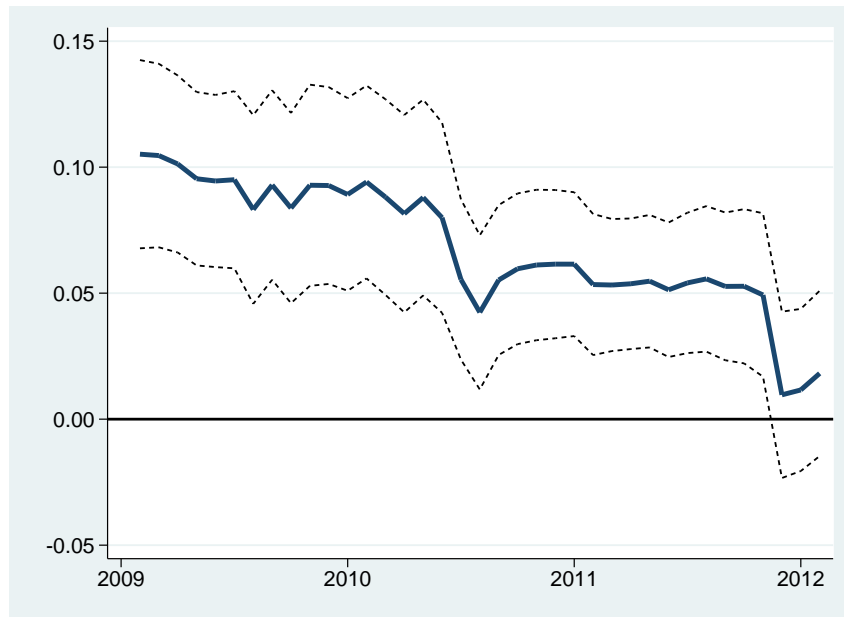
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[13] We cannot do this for the δ coefficient as we cannot estimate it for each country.

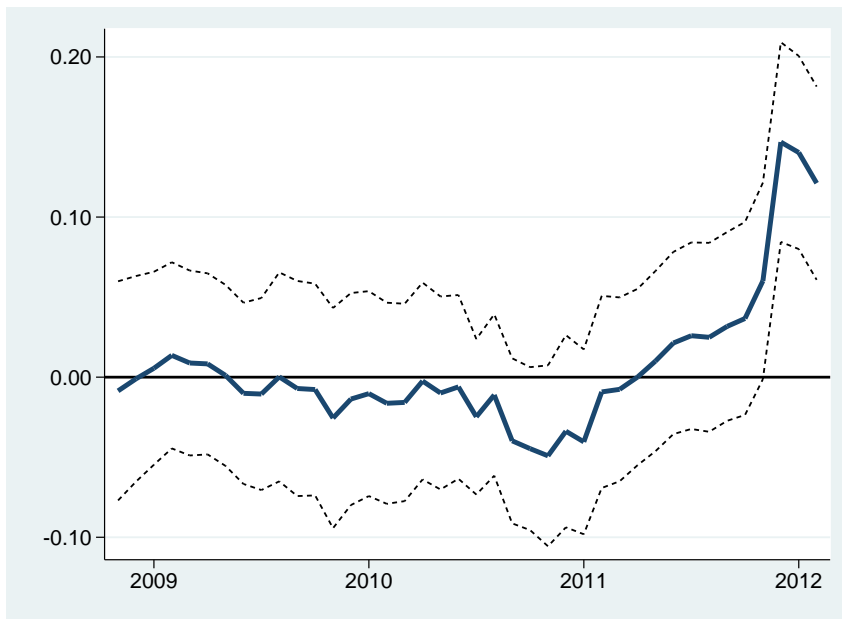**Figure 6. The Changing Effect of Inflation in Relation to Target on Expectations (Delta coefficient)**
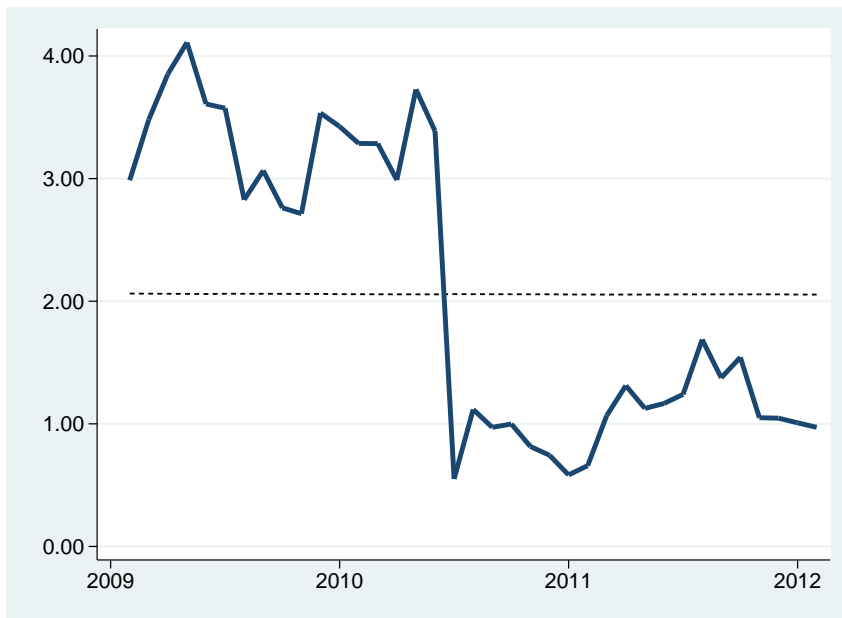

Figure 7. Rolling Poolability Test on the Effect of Current Inflation on Expectations (Beta coefficient)

Note: F-test where the null hypothesis of poolability test is homogeneity across countries. Values above the dashed-line indicate rejection of the null at 95%.

7 On the Persistence of Inflation Process

One potential objection to our results is that credibility has not changed at all, but rather it is the nature of the inflation process itself that has changed. In particular, if the persistence of inflation shocks has fallen, then inflation shocks would be expected to have a lower impact on medium-term inflation expectations, even if credibility has not changed at all.[14] In this section we therefore conduct an analysis to see if the underlying persistence of the inflation process has changed.

To test the persistence of inflation we use a procedure proposed by Stock (1991), that shows how to employ asymptotic theory to generate the distribution of a unit root test statistic such as the Dickey and Fuller (1979) test. We construct these confidence intervals using this procedure and the estimates from the Dicker-Fuller procedure.

The advantages of this proc are twofold. First, the method provides a measurement of persistence while a unit root test would only provide a "rejection" or a "non-rejection" of the null. Second, this approach recognizes explicitly that the distribution of the estimated coefficient (of the largest auto-regressive root) is not normal. Moreover, the distribution becomes increasingly non-normal the closer it becomes to unity. A caveat however, emphasized by Phillips (2012), is that the procedure may fail to deliver unbiased and robust confidence intervals when the process is "highly stationary".

In this case, we split our sample in two and use annualized monthly inflation to calculate the LAR. Figure 8 shows the results. The persistence of inflation shocks does appear to have decreased in some cases, but in the vast majority of cases, the confidence intervals overlap. We therefore conclude that there is not strong evidence in favor of the view that inflation shocks themselves have substantially changed.

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[14] Of course, if the persistence of shocks has changed one might still consider that to be endogenous to the regime in place. We set aside this possibility in what follows.

Figure 8. Inflation Persistence, has it changed over time?
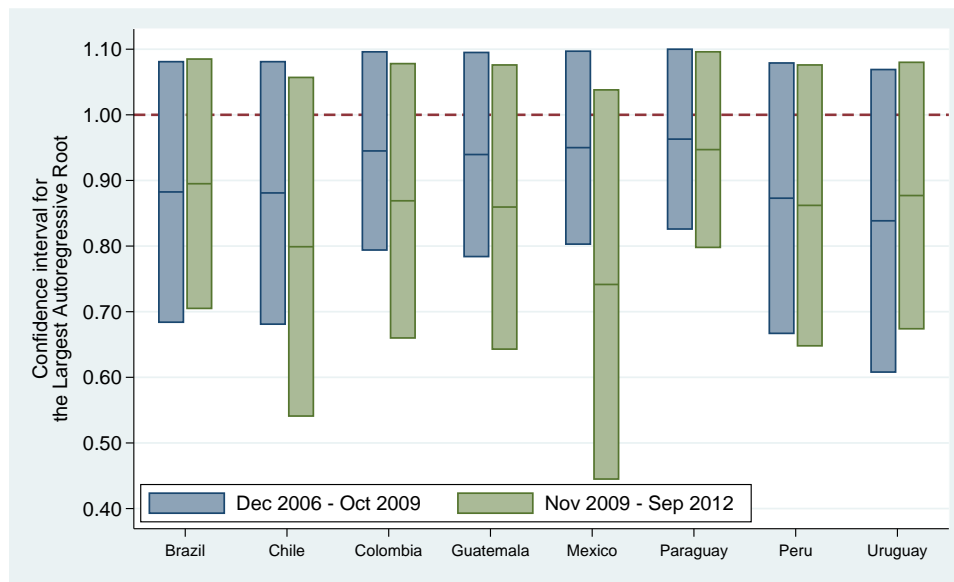
Note: Graphs Illustrate Confidence Intervals of the Largest Autoregressive Root (Stock, 1991) in Two Time Periods.

8   Conclusions

Several countries in Latin America have adopted inflation targeting regimes. In this paper we have attempted to investigate whether, given this regime, medium-term inflation expectations are well anchored in the face of shocks to the current inflation rate. It might be argued that having well-anchored inflation expectations is a necessary condition for a highly credible regime, as credibility requires an expectation that the relevant authorities will take appropriate action to maintain inflation within the stated targets in the face of economic shocks.

We employed a simple econometric methodology to test whether medium-term inflation expectations respond to inflation shocks controlling for lagged inflation expectations. We also took advantage of a publicly available database on inflation expectations in the region. Our results indicate that over the whole sample period inflation expectations were not fully anchored and did indeed respond to inflation shocks, although in most cases the magnitude of the effects appears relatively small. Moreover, we found that over time, in most cases the relevant coefficients decreased over time and in the final time window considered were, in general, not significant in individual country regressions, nor in rolling panel regressions across countries. While there may be several different interpretations for these results, they do seem consistent with the view that the credibility of the inflation targeting regimes in Latin America has deepened over time and that in the final period shocks to inflation had little impact on medium-term inflation.

20

However, there is also evidence in the last time period that when inflation in the previous period exceeds the stated target then there is an impact of inflation on inflation expectations. This suggests that while overall credibility may have been enhanced in Latin America, there is a cost to deviating from the stated inflation target. While there is much discussion at present regarding the future of inflation targeting and whether central banks should have other objectives as well as stable prices, we hope that this analysis might be a useful contribution to the debate. In particular, as the results do indicate that inflation expectations have become more anchored, we therefore argue some degree of credibility has been gained, it seems worthwhile to consider how to maintain that credibility in whatever reforms may be considered.

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