CONSTRUCTING A STICKY PRICE (INERTIAL) INFLATION INDEX

Daniel Karp*
daniel.karp@santander.com.br
+5511 3553 9828
Felipe Kotinda*
felipe.kotinda@santander.com.br
+55 11 3553 9828

- Inertia, or the influence of past inflation on price-setting policies, which makes prices stickier, is one of the main drivers of inflation in emerging economies, particularly in Brazil.

- The services group encompassed in the IPCA index is known for having the highest level of inertia. Although theory and data corroborate that statement, we argue that using the whole services group as a proxy for sticky/inertial prices could be misleading, as the prices for some services items are volatile.

- In this report, we aim to construct, in a statistical manner a "sticky inflation" index, a "semi-sticky" inflation index, and a "volatile" inflation index, in order to better assess the impact of inertia dynamics on the IPCA index.

- When comparing the sticky inflation index with services inflation, we find that our index has a lower weight in the IPCA index, suggesting that the number of inertial components encompassed in the IPCA index could be lower than what common knowledge suggests.

- Moreover, the volatility of our sticky inflation index is lower than services volatility, which is a desirable feature for an index intended to gauge inertia.

- Finally, in the coming months we forecast the sticky inflation group to continue rising, with services stabilizing, but we expect both to decelerate 2Q23 onward.

Introduction

Inflation is currently in the spotlight of macroeconomic discussions. All major central banks are raising interest rates, and, as a result, the discussion is now turning toward the speed of the disinflation process ahead. A major part of the discussion is focused on how commodity prices, exchange rates, inflation expectations, and the output gap will drive the disinflation process. However, inertia plays an important role in inflation dynamics and is usually an overlooked driver, in our view.

Particularly in emerging countries, inertia, or the influence of past inflation on price-setting policies, is usually more important than in developed countries. In Brazil, where many price-setting policies are formally based on past inflation, inertia is basically the main driver of inflation for many items that compose the IPCA, the official inflation index.

In Brazil, services prices are known to have a high inertia vs. other groups, such as food-at-home, industrial goods, and regulated prices, and services is usually used as a proxy for "inertial inflation". Although theory and data corroborate that statement[1], it is also well-known that items belonging to other groups present high inertia as well. For example: health insurance is a regulated price for which the price-setting policy is based mostly on

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[1] The rationale behind it is that labor is basically the main cost of services, and wages in Brazil—particularly the minimum one—are indexed by past inflation, so it ends up influencing services inflation. BCB's models show that the inertia coefficient of services is 0.64, vs. 0.40 of industrial goods and 0.51 of food-at-home (BCB's Quarterly Inflation Report – 1Q21 – "New small-scale disaggregate model").

past inflation. As a result, simply assuming that services is the high inertia group and the others are low inertia (or highly volatile) can be, at least, misleading.

In this report, we aim to construct, in a statistical manner, a sticky inflation index, a semi-sticky inflation index, and a volatile inflation index. In order to achieve this goal, we take the 51 subgroups of the IPCA index and estimate an autoregressive regression for each subgroup. We then take the autoregressive coefficients and rank them from the highest to the lowest and divide the list into groups of three equal lengths. The first group is the sticky inflation index, the second is the semi-sticky index, and the third is the volatile index'.

For each group, we list which subgroups compose each index, calculate the weight of each of the indices in the IPCA index, describe the recent dynamics, and report our forecasts. We also compare the sticky inflation index with services inflation, both in terms of their weight in the IPCA index and in terms of recent dynamics and forecasts, highlighting the differences between each index.

Constructing the Sticky, Semi-Sticky and Highly Volatile Inflation Indices

To construct the sticky, semi-sticky, and highly volatile inflation indices, we first take the time-series of the 51 subgroups of the IPCA index in the form of quarterly changes (in %) and estimate an autoregressive regression (with seasonal dummies) for each subgroup. Second, we take the autoregressive coefficients (the lag of the own variable, AR(1)) and rank them from the highest to the lowest. Then we separate them into groups of three equal lengths: the first one (with the highest AR(1) coefficients) is the sticky inflation group, the second is the semi-sticky group, and the last is the volatile group.

The sticky inflation index is composed of the IPCA index's subgroups, with autoregressive coefficients ranging from 0.44 to 0.81, with the average being 0.61. This means that the components of the sticky inflation index, on average, have a half-life of 1.4 — in other words, an inflation shock takes 1.4 quarters to be halved. The index components' weights add up to 28% of the IPCA index. Of this 28%, services items — known for being highly inertial — are almost half (47%). Industrial goods are 27% of the index, but the food items that enter the index weighing 14% are mostly industrialized items, so one could say that industrial goods are basically 41% of the highly inertial group. Finally, regulated prices appear with just one item (health insurance) having a weight of 12% of the group. An interesting point is that prior to the study, we expected that services items would add up to more than 50% of sticky inflation (at least), but that was not the case when we constructed this index based on the statistics.

The semi-sticky inflation index is composed of the IPCA index's subgroups with autoregressive coefficients (inertia) ranging from 0.19 to 0.42, with the average being 0.28. This indicates that a shock in the average component of the index takes 0.5 quarters (half-life) to decrease by half — basically, three times faster than the sticky inflation index items. The semi-sticky inflation items add up to 33% of the IPCA index. In this case, industrial goods are the heavier items composing the index, with 39% of the weight. The second heaviest items come from the services group, 27% of the index. As for food items and regulated prices, each weighs 17%.

The volatile index is composed of items with inertia coefficients ranging from -0.22 to 0.18; the average is 0.00. This means that for the average item in this index, shocks do not have an inertial effect on inflation, which is exactly what we aimed for when constructing this index. The volatile items add up to 40% of the IPCA index. The heaviest items in the highly volatile index are regulated prices, at 44%. Interestingly, services are the second heaviest items, weighing 30% of the index, despite the common knowledge that services inflation as a whole tends to be more inertial. Food items weigh 18% of the index, and industrial goods just 8%.

Figure 1. Sticky, Semi-Sticky and Volatile Inflation Index Composition and Autoregressive Coefficients

Sticky	Coef AR(1)	Semi-sticky	Coef AR(1)	Volatile	Coef AR(1)
Health insurance	0.81	Salt and condiments	0.42	Clothing fabrics	0.18
TVs, soundsytems and computers	0.75	Jewelry	0.39	Pharmaceutical products	0.16
Medical and dental services	0.74	Rents	0.37	Fruits	0.12
Food-service	0.69	Personal vehicle	0.36	Chicken and egg	0.11
Repairs	0.65	Bed, table and bath	0.34	Sugas	0.10
Beverages	0.64	Stationery items	0.30	Milk and dairy	0.07
Furniture	0.63	Reading	0.29	Repairs and maintenance	0.07
Decoration	0.62	Men's clothing	0.29	Electrical energy	0.06
Flours, starches and pasta	0.61	Oils and fat	0.28	Fuels (vehicles)	0.05
Footwear	0.60	Cereals and oilseeds	0.26	Regular education fees	0.01
Personal services	0.58	Fish	0.25	Recreation	-0.03
Home appliances and equipments	0.55	Fuels (domestic)	0.22	Other education fees	-0.06
Glasses	0.54	Children clothing	0.22	Communication	-0.07
Women's clothing	0.49	Meat	0.22	Cigarrettes	-0.13
Canned food	0.49	Personal hygiene	0.21	Tubers, roots and vegetables	-0.16
Cleaning items	0.46	Laboratory and hospital services	0.20	Public transportation	-0.19
Bread	0.44	Industrialized meat and fish	0.19	Vegetables and greens	-0.22
Average	**0.61**	**Average**	**0.28**	**Average**	**0.00**

Sources: IBGE data, Santander research.

Figure 2. Weights of IPCA Groups in Each Proposed Index

	Sticky		Semi-sticky		Volatile	
	Weight	Relative Weight	Weight	Relative Weight	Weight	Relative Weight
Services	13%	47%	9%	27%	12%	30%
Industrial goods	8%	27%	13%	39%	3%	8%
Food-at-home	4%	14%	6%	17%	7%	18%
Regulated prices	3%	12%	6%	17%	18%	44%
Total	**28%**	**100%**	**33%**	**100%**	**40%**	**100%**

Sources: IBGE data, Santander research.

Recent Dynamics and Forecasts for the Sticky, Semi-Sticky, and Highly Volatile Indices

The standard deviation of inflation in each index, by construction, behaves as expected: the standard deviation (SD) of the quarterly change in sticky inflation index is 0.7%, while for the semi-sticky index, the SD is 0.9% and for the highly volatile it is 1.8%. This implies that sticky inflation tends to be slower and more inertial whereas the highly volatile index tends to see many more spikes, while the semi-sticky is in between.

When analyzing the dynamics since the beginning of the pandemic, we see that acceleration in the sticky inflation group took some time to begin. More precisely, it started to rise in YoY terms in December 2020 and continued to increase at a slow rate of 0.30% YoY on average each month, rising from around 2.0% YoY pre-pandemic to 9.5% in July 2022. At the margin, the index is still rising, and we forecast, given its inertial behavior, that the trend is likely to continue until February 2023, when we expect it to reach a peak of 10.3%, followed by deceleration to 6.3% by YE2023.

As for semi-sticky inflation, that index started to rise more sharply around July 2020 — that is, before the sticky inflation index. The pace of acceleration was similar to the sticky inflation index: 0.35% YoY on average each month, but with more volatility. The index rose from around 4.0% YoY pre-pandemic to 11.7% YoY in July 2022. Unlike the sticky inflation index, however, the semi-sticky inflation index presents preliminary evidence of stabilization at the margin, and we expect it to indeed stabilize at around the 11% YoY by YE2022 and then decelerate more sharply until it reaches 4.7% at YE2023.

The highly volatile index saw inflation rising sharply during the beginning of the pandemic, in line with expectations, as many shocks were hitting the economy at the same time. The average pace of acceleration

was 0.65% YoY monthly, with the index rising from 0.30% YoY to a peak of 17.5% YoY in November 2021. Since then, inflation was relatively stable until June 2022, but in July it saw a sharp decline to 10.4% YoY. Although we expected a decline in July, and the index indeed comports with declines of that magnitude, it is important to highlight that the movement was potentialized by an idiosyncratic tax cut on the two major components of the group: electrical energy and fuels. We expect the steep deceleration to continue until the index reaches 1.00% YoY by April 2023, but after that we forecast a rebound to 6.3% YoY, considering the likely reinstatement of part of the taxes that were cut.

Figure 3. Sticky Inflation Index QoQ %
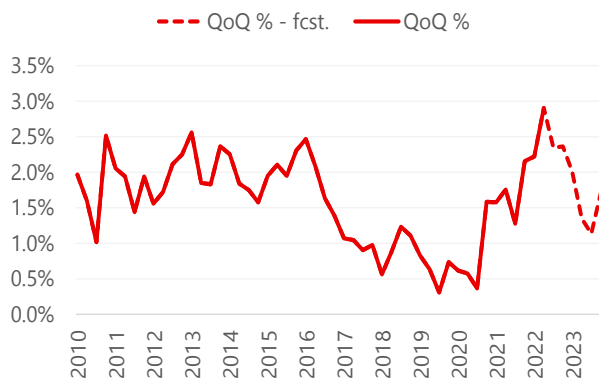
Figure 4. Sticky Inflation Index YoY %

Figure 5. Semi-Sticky Inflation Index QoQ %
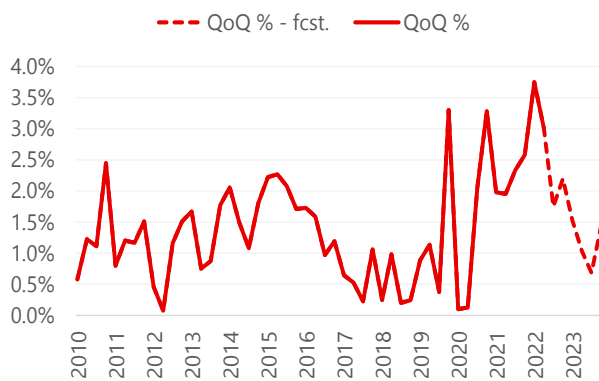
Figure 6. Semi-Sticky Inflation Index YoY %

Figure 7. Volatile Inflation Index QoQ %
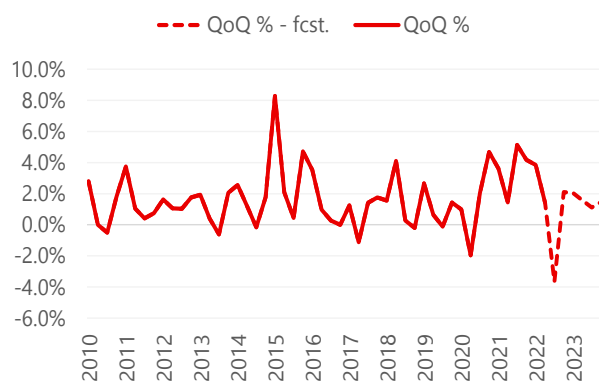
Figure 8. Volatile Inflation Index YoY %

Sources for Figures 3-8: IBGE data, Santander research.

Figure 9. Sticky, Semi-Sticky and Volatile Inflation Indices % YoY
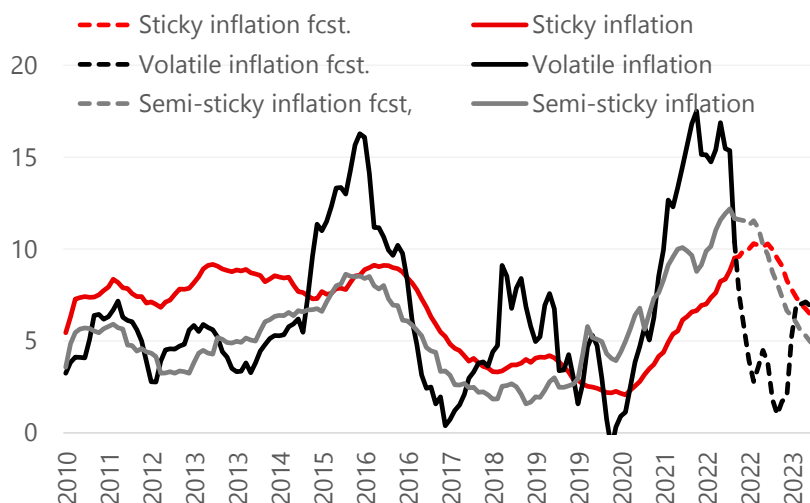
Sources: IBGE data, Santander research.

Comparison of Sticky Inflation and Services Inflation

The Brazil Central Bank (BCB) usually aggregates the items in the IPCA index by four groups: services, industrial goods, food-at-home, and regulated prices. Of these four groups, special attention is given to services because it is known to have sticky prices and consequently inertial inflation, and thus it is more difficult for the BCB to fight inflationary pressures in this group. Indeed, in a study conducted by the BCB, it was highlighted that: "Inflation in the sector of services has the highest inertia (…)"[2] when compared to the other groups.

However, items belonging to other groups also present high inertia — for example, health insurance is a regulated price for which the price-setting policy is based mostly on past inflation. At the same time, some items belonging to the services group, such as air fares, are known for being highly volatile, hence not inertial. As a result, simply assuming services is the high inertia group and the others are low inertia (or highly volatile) is not entirely correct.

Next, we aim to compare our sticky inflation indicator with services inflation. First, we highlight the results of section one (Figure 2), where, through a statistical approach, we have shown that although services items have the highest weight in the sticky inflation indicator, they add up to a bit less than half of the indicator. This is preliminary evidence that assuming services as a whole is inertial can lead to an incomplete assessment.

Another important result is that services items appear in all the three indicators, separated by the level of inertia. Indeed, of the 34% weight that services have in the IPCA index, 13% are in our sticky inflation index, 9% are in the semi-sticky index, and, surprisingly, 12% are in the volatile inflation index — that is, the sticky inflation index and the volatile index encompass nearly the same number of services items. Therefore, it would be misleading to assume that all services are inertial.

Moreover, it is also worth highlighting that while services weigh 34% in the IPCA index, the sticky inflation index weighs 28% of the index. This suggests that the inertial components of the IPCA index could be lower than what common knowledge suggests.

Regarding recent dynamics, after the pandemic hit the economy, services inflation growth fell sharply, from around 3% YoY in March 2020 to 1% YoY by August 2020 — which is explained by the fact that the services sector was the most affected by pandemic-related lockdowns, however, is not the expected behavior for an inertial series). After August 2020, services kept running at around the 1% until April 2021 and then accelerated

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[2] BCB's Quarterly Inflation Report – 1Q21 – "New small-scale disaggregate model".

sharply to the fast rate of 0.50% YoY monthly on average, reaching 8.9% YoY as of July 2022. This strong acceleration is also an undesirable feature for a series expected to be inertial.

As for sticky inflation, it ran below services pre-pandemic, at around 2% YoY, and mostly remained at that level until November 2020; so, once services inflation collapsed, sticky inflation started to run above the rate of services inflation. Then, after November 2020, sticky inflation accelerated, but at a slower pace of 0.3% YoY monthly. This means that even with services falling sharply at the beginning of the pandemic, services inflation basically caught up with sticky inflation at the margin, showing a more volatile pattern. Indeed, the volatility of quarterly inflation for the sticky inflation index is 0.7%, whereas the volatility of services is 0.9%.

Looking a few months ahead, we forecast an important difference between services and the sticky inflation indicator. While we expect services to remain stable at around 9.0% YoY until April 2023 — that is, no more acceleration — we expect sticky inflation to continue rising until a peak of 10.3% in February 2023. By the second quarter of 2023, we estimate both will decelerate, both ending 2023 at around 6.3%.

Figure 10. Sticky Inflation Index and Services Inflation
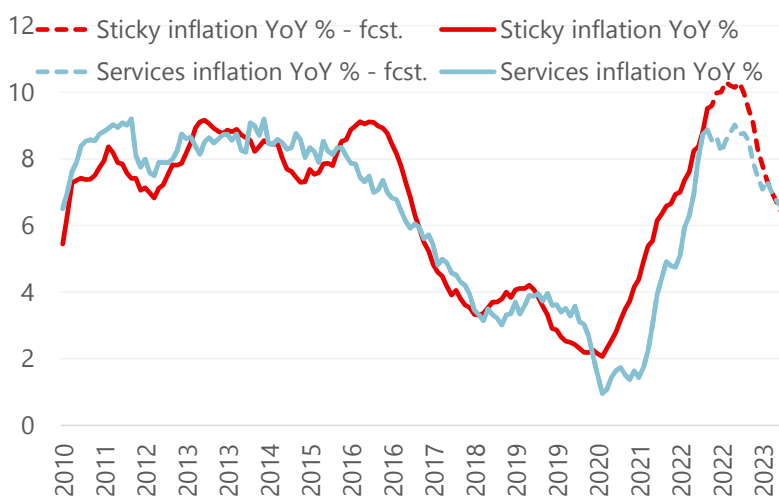
Sources: IBGE data, Santander research.

Conclusion

In this report, we propose three new measures of inflation graded by the level of stickiness. In our view, these new gauges are an improved way to track the inertia present in IPCA inflation.

In particular, when comparing the sticky inflation index with services inflation, we highlight that our index has a lower weight in the IPCA index, suggesting that the inertial components of the IPCA index may be smaller than what common knowledge suggests.

Moreover, the volatility of our sticky inflation index is lower than services volatility, which is a desirable feature for an index intended to gauge inertia.

Finally, in the coming months we forecast the sticky inflation group to continue to rise (while services should stabilize), but after the second quarter of 2023 we expect both to decelerate.

CONTACTS / IMPORTANT DISCLOSURES

Brazil Macro Research

Ana Paula Vescovi*	Chief Economist	anavescovi@santander.com.br	5511-3553-8567
Mauricio Oreng*	Head of Macro Research	mauricio.oreng@santander.com.br	5511-3553-5404
Jankiel Santos*	Economist – External Sector	jankiel.santos@santander.com.br	5511-3012-5726
Ítalo Franca*	Economist – Fiscal Policy	italo.franca@santander.com.br	5511-3553-5235
Daniel Karp*	Economist – Inflation	daniel.karp@santander.com.br	5511-3553-9828
Tomas Urani*	Economist – Global Economics	tomas.urani@santander.com.br	5511-3553-9520
Lucas Maynard*	Economist – Economic Activity	lucas.maynard.da.silva@santander.com.br	5511-3553-7495
Felipe Kotinda*	Economist – Commodities	felipe.kotinda@santander.com.br	5511-3553-8071
Gabriel Couto*	Economist – Special Projects	gabriel.couto@santander.com.br	5511-3553-8487
Fabiana Moreira*	Economist – Credit	fabiana.de.oliveira@santander.com.br	5511-3553-6120
Gilmar Lima*	Economist – Modeling	gilmar.lima@santander.com.br	5511-3553-6327

Global Macro Research

Maciej Reluga*	Head Macro, Rates & FX Strategy – CEE	maciej.reluga@santander.pl	48-22-534-1888
Rodrigo Park *	Economist – Argentina	rpark@santander.com.ar	54-11-4341-1272
Ana Paula Vescovi*	Economist – Brazil	anavescovi@santander.com.br	5511-3553-8567
Juan Pablo Cabrera*	Economist – Chile	jcabrera@santander.cl	562-2320-3778
Guillermo Aboumrad*	Economist – Mexico	gjaboumrad@santander.com.mx	5255-5257-8170
Piotr Bielski*	Economist – Poland	piotr.bielski@santander.pl	48-22-534-1888
Mike Moran	Head of Macro Research, US	mike.moran@santander.us	212-350-3500

Fixed Income Research

Juan Arranz*	Chief Rates & FX Strategist – Argentina	jarranz@santanderrio.com.ar	5411-4341-1065
Mauricio Oreng*	Senior Economist/Strategist – Brazil	mauricio.oreng@santander.com.br	5511-3553-5404
Juan Pablo Cabrera*	Chief Rates & FX Strategist – Chile	jcabrera@santander.cl	562-2320-3778

Equity Research

Miguel Machado*	Head Equity Research Americas	mmachado@santander.com.mx	5255 5269 2228
Alan Alanis*	Head, Mexico	aalanis@santander.com.mx	5552-5269-2103
Andres Soto	Head, Andean	asoto@santander.us	212-407-0976
Walter Chiarvesio*	Head, Argentina	wchiarvesio@santanderrio.com.ar	5411-4341-1564
Mariana Cahen Margulies*	Head, Brazil	mmargulies@santander.com.br	5511-3553-1684
Murilo Riccini*	Head, Chile	murilo.riccini@santander.cl	56 22336 3359

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