Decentralizing the CPI

Through Decentralized Fact-checked Objectivity(D-FACTO)

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Abstract

"But in this world, nothing can be said to be certain, except death and taxes", unfortunately Benjamin Franklin was wrong (e.g. tax havens Cayman, Bahamas), it's "death and inflation". Everyone is affected by inflation! Governments track inflation and use it to create and change policies that have a direct effect on people's well-being. Since 2008, open networks (Bitcoin, Ethereum, etc...) have focused on improving our financial system by removing intermediaries. However, we can use this technology to build an inflation measure that can be independently reproduced with transparency of the underlying data, outlier detection methods, and index methodology. No paywalls, no obscurity, but rather an independent and transparent inflation measure to use as a reference point in the world's future financial systems.

Introduction

Antitrust laws have long been in place in the US to prevent monopolies because unchecked market power leads to the exploitation of customers. The lack of competition leaves customers with no choices, no product improvements, unimpeded price fixing, and cost-push inflation. Similar shortcomings are also inevitable when governments and powerful institutions don't face competition: that's where crypto and open systems come into play and why an independent and transparent measure of inflation is necessary.

This seemingly insignificant metric is more powerful and more politicized than most care to admit. In the US, the first cost-of-living survey was commissioned after the McKinley Tariffs[i] to track who was right about its effect on people: democrats or republicans? Statistical agencies exist to provide everyone unbiased economic measures. Unfortunately, depending on the region or political climate, not all of them are able to fend off political coercion. Let's look at Argentina's case:

> Argentina stopped publishing a CPI measure after it openly admitted to manipulating the numbers. "The official consumer price index (CPI) of Argentina became widely discredited after January 2007 and the National Institute of Statistics and Censuses of Argentina (INDEC) ceased its production in December 2015, leaving the country with no official measure of inflation after this date." (Cavallo and Bertolotto)[ii] Methodology has been revised since then and the country has resumed publishing a CPI.

Fast forward to 2023:

> Argentina's annual inflation rate hit 109% on May 2023[iii], the first time over 100% since Oct 1991. Interest rates were 97% on May 2023[iv]. Yes! May 2023. This is not a history lesson. By increasing the interest rate the government is attempting to slow down the velocity of money, which should decrease the money supply, inflation, and hopefully their currency will stop devaluating. The government has also implemented currency exchange controls, like fixing the official exchange rate of the Argentine Pesos to USD and limiting the amount of USD people can legally exchange, which in turn has created a black market for USD.

It's debatable if Argentina would be better off if they had implemented policies based on unbiased economic statistics, but certainly good polices cannot come from purposefully flawed data.

These economic earthquakes are not often observed in developed and no-conflict countries. But that doesn't mean it does not have a spillage effect. When it comes to the economy, countries' boundaries are but a mere mirage.

Background

The Bureau of Labor in the US was created in 1884. It was created for political reasons, and in its early years survived many budget cuts and opposition to its existence. It subsisted because of labor disputes and wage adjustment battles between unions and companies. The first consumer expenditure survey was done in 1888-1890. The first time the US government commissioned a study on household expenditures, wages, prices, and hours worked was in 1891 after the government implemented the McKinley Tariffs that aimed to reduce imports and the government budget surplus. They increased tariffs from 38 % to 49.5 % and wanted to study the effect on wages and prices. Over the years, the budget for the Bureau of Labor (now the Bureau of Labor Statistics) was heavily politicized and its statistics purposefully biased by only including married Caucasian male wage earners in urban areas. Over the years it has become more inclusive, for example, in 1941 Black and Hispanic families were included in the survey but with undisclosed and deliberate underrepresentation in the survey. And in 1978, large amounts of research efforts were made that led to revisions and creating a new market basket (it went from specific items to categories), reweighing them and getting prices for them. The survey went from semi-annual rent data to monthly but research did not address the population coverage or addressed quality changes.[v] In the US, now they have addressed these discrepancies but with its history it's easy to see why labor unions, companies, and its diverse citizens do not trust the statistics being published.

What is the CPI?

The CPI attempts to measure the cost-of-living over time: how much it would cost you today to buy the same goods and services you were buying a year ago (or some base period)?

How is it used?

Ideally the CPI helps governments evaluate the needs of the people and create policies and regulations that will bring a higher standard of living for everyone in the country. Inflation measures are used widely by governments to adjust government assistance payments, evaluate income eligibility levels for government assistance programs, for cost-of-living income adjustments, price escalation clauses, and changing monetary policy. Businesses also use it for wage and price escalation clauses. Few measures of the economy have such a direct impact on so many people's lives, including yours!

Why is the CPI criticized?

The CPI is only one of the many Principal Federal Economic Indicators[vi] used by regulators, businesses, and people to make financial decisions. The CPI is calculated monthly based on a sample. For proprietary reasons and generally because of non-response to voluntary surveys, it is not feasible to collect the universe of data available to truly measure inflation. However, with a representative sample, a population measure can be extrapolated.

There are three age old criticisms of the CPI methodology: 1) **Substitution bias** - Substitution bias happens when budgets get tight, and most people will substitute items they prefer to more genetic items or to purchase more of the items that have little price changes relative to other items in their

basket of goods. 2) **Lagged inclusion of new items** - Because the basket of goods is selected at some starting period, the introduction of new items is lagged and as the basket of goods changes for the consumer the CPI continues to measure an old basket, and this can skew the estimate. 3) **Unmeasured or poorly measured changes in quality** – This criticism comes from the difficulty of separating price changes that comes from a change in quality of the item from that of inflation. These three age-old criticisms are valid and as such, there has been more research done to continue to improve upon these.

However, a more recently noted and bigger problem than the limitations of data collection and quality adjustments is 4) **Conflict of interest!** Just like in Argentina, governments have an incentive to push the CPI in one direction or another depending on policy objectives. Conflict of interest coupled with centralization, power, and lack of transparency[vii] lead to tyranny. The underlying data used by governments are inaccessible, hence, the index cannot be openly recreated and fact checked: this is where open networks can radically improve the index!

Decentralized research system

The CPI will be the first use case for the decentralized research system, D-FACTO. An open and decentralized research system can allow for funding, data, and methodology transparency, and decentralized and specialized data collection: these features lead to ***decentralized fact-checked objectivity (D-FACTO).***

Currently most surveys for the common good are funded publicly via taxes, response is voluntary, and yet millions of data records are collected every month. A decentralized research system would allow people to provide data for common goods voluntarily as they do now or through incentives and allow funding for focused studies transparently.

Data transparency

Many sanctioned surveys, research projects, and studies are paid for by organizations with conflicting interest and the reported conclusions are not always as objective as they should be. With an open system where all the data is available transparently, credibility and objectivity can be regained even when there is a conflict of interest between the funding party and the conclusion. This applies to both, government and privately sanctioned studies.

Methodology transparency

Designing a study and its methodology is a difficult process usually done by a few highly specialized individuals but once this is done companies are often funded (hired) for the data collection process. In theory, given the same design, methodology, geological location, and similar sample selection method for the same population, a second and independent study should reach a similar conclusion, even with a different sample. A second study that reaches a similar conclusion will add to the robustness of the study.

Even though the methodology for a study can be purposefully mis-designed to achieve a certain outcome/conclusion making the methodology transparent will allow other experts to provide feedback before data collection begins or to quickly dispute the validity of the outcome or

conclusion. Having the full methodology, including exact questions asked, outlier detection methods, and data used in the study make it easier to spot irregularities and regain credibility.

Decentralized Data Collection

Data collection companies are often given strict guidelines, training, and sometimes even on-site supervision but ultimately outlier detection methods will be implemented before the data is finalized and conclusions can be reached. Raw data collection and its availability is what differentiates the decentralized research system and where open networks bring in vast value. **Decentralized oracles** will facilitate data collection and data transparency.

Some data (e.g. an aggregate index) will go straight on-chain while large amounts of data (e.g. the microdata used to create the index), research design, and methodology can be saved to decentralized storage platforms (DSP) (e.g. IPFS, once data is saved in IPFS the hash of the data becomes the address. This prevents tampering with the data since changing the data would change the hash/address of the information.). Using a DSP will ensure the raw (no outlier detection methods applied) data is not tampered with after it's loaded and provide decentralized availability.

Decentralized Research System framework

The framework for the decentralized research system (D-FACTO) is fairly simple:

1. Initiate research through the D-FACTO

The first step in commissioning research through the D-FACTO will be to publish the initial research specification and disclosure of the funding party on a DSP. This information will be cross referenced on the data collected for that study.

2. Incentivize data collection.

The steps to initiate data collection are to develop data scrapers, incentivize data collection, data saving on a DSP, and reporting the data on-chain. The raw data (prior to clean up or outlier detection) collected will be saved on a DSP during the data collection phase and its address saved on chain to ensure no tampering.

3. Allow time for data collection and raw data publication.
4. Finalize research.

The last step on research funded through D-FACTO is loading the finalized methodology and computer programs to a DSP for easy recreation and objectivity inspection.

Future research for D-FACTO:

- Decentralize peer-review

Funding

Initial funding for the D-FACTO framework will be donations (financial and volunteer developers) and later through fees on research funded through it. Research can be funded using highly liquid tokens such as ETH and TRB. Highly liquid tokens can be immediately used to incentivize development of data scrapers, product classification programs, outlier detection, common goods methodology research, and pay for the data collection (decentralized oracle).

Anyone that is truly data driven and is not misusing studies to only support their marketing strategy should be open to higher degree of transparency than what is currently available.

Why a decentralized CPI?

With trust in governments declining[viii] and with the understanding that this statistical measure has a direct effect on people's lives, it is only logical that people should have a way to properly fact check government provided statistics. A fact-checking mechanism can act as direct public oversight. People will still have to wait for elections to make their voices heard but they will have transparent data that will help them advocate for better fiscal and monetary policy.

Just like crypto currencies can allow people to decrease their risk exposure of their government's fiat system (and mismanagement of it) a transparent measure of inflation can allow people to reign in their governments economic policies before it is too late.

Methodology

Sample

The initial index methodology proposed is similar to the one applied by Alberto Caballo and Manuel Bertolotto, to recreate Argentina's CPI when the official CPI ceased to be published. The methodology used data scraping to collect online prices for household products as its primary data source. They used this data along with government provided data to assign weights to categories for the basket of goods.

Previous research by Alberto Caballo and Roberto Rigobon observed that offline and online prices show to be highly correlated[ix]. MIT billion prices, PriceStats and Inflacion Verdadera (Inflation measure for Argentina and Venezuela) all use(d) scrapped data to support their indices[x]. Their initial research was completed before the 2020 pandemic when many people changed their spending habits from physically going to the store to ordering online. Although the pandemic is over, a lot more items are now widely bought and available online than pre-pandemic and online and offline prices are still highly correlated.

No adjustments

Collecting data directly from online retailers allows new items to become part of the sample faster. The sample is updated based on the available products. Discontinued items are excluded from the index and substitutions are not forced so quality adjustments are not needed.

Index

The initial index methodology will follow Caballo's methodology for recreating Argentina's CPI.[xi] They used an "unweighted geometric mean within categories and a weighted arithmetic mean across categories to create a supermarket index"[xii]. The paper only talks about one supermarket that held a significant market share for Latin America. Similar methodology will be used but expanded across online retailers. The goal is to collect and classify data from as many online retailers as possible. However, once the initial data is collected further research will help finalize the methodology.

The base year for the index will be the same as the US CPI. Categories will be the same as the US categories to make use of the official category weights[xiii]. As other countries are added to the index the base year and categories will be standardized to allow high level index comparisons and eventually create a Decentralized World Inflation Index[xiv].

Categories	US City Avg CPI-U	US City Avg CPI-W[xv]
Food and beverages	14.376	15.778
Housing	44.3384	42.668
Apparel	2.479	2.976
Transportation	16.744	18.164
Medical care	8.108	7.067
Recreation	5.385	4.735
Education and communication	5.845	5.792
Other goods and services	2.677	2.821
Currency transactions *		
Other black-market items *		

Source: Bureau Of Labor Statistics, Table 1 Table 1 (2021 Weights). Relative importance of components in the Consumer Price Indexes: U.S. city average, December 2022 https://www.bls.gov/cpi/tables/relative-importance/2022.xlsx
* for future exploration

Black markets

A decentralized CPI provides the unique opportunity to collect anonymous voluntary data about black markets. Black markets are created when there is demand for things the government deems illegal, imposes high taxes on, or rations. Drug trade and illegal currency transactions are examples of black markets that can influence the economy and that go unreported. For example, in Argentina, there is a black market for USD because as inflation for the Argentine peso continues to rise the government has capped the amount of USD that can be obtained while also imposing an official exchange rate. The exchange rate is much higher in the black market, since people are

eager to get their hands on USD, and that has contributed to higher inflation and mistargeted policies.

Developing the first Decentralized CPI

Now that we have an initial framework for the index methodology, the more technically challenging parts of creating an index must be addressed. The next step to creating a decentralized CPI is to begin collecting data. Incentives to develop data scrapers and incentivize decentralized data collection are in first order. Once the initial data is collected programs for automated product classification, outlier detection, and index aggregation can be created.

1. Data scrapers

Identify the online retailers to develop data scrapers and maintain them. Data scrapers need to be in constant maintenance because there can be formatting changes or added restrictions, and these have to adhere to any changes in legal restrictions and terms of use by the websites.

2. Incentivizing decentralized oracles for data collection

Incentives for decentralized keepers to run data scrapers, save data on a DSP, and oracles to report the data address/hash on-chain will be necessary. Data scrapers will be the primary software provided for data collection. The network of data scrapers and an oracle protocol will be D-FACTO's "data collection agency".

A data specification[xvi] will be created for the CPI for each specific country and everyone interested on seeing the data being scraped can freely incentivize the data scrapers and data reporters. On-chain events for payments or donations for data scrapers and data collections will be tracked as a measure of demand and that will drive the growth of the index.

Predecessor: Data scrapers

3. AI automated product classification

Proper item classification and weighting is of outmost importance since this process ultimately determines how well the population value will be approximated by the sample. For example, if a house is wrongly classified into the Food index with a 15% weight, when housing has a 40% weight a change in the price of the house would not be properly reflected by the aggregate index and the Food index would be skewed. AI automated classification will classify items based on their description or retailer codes into the categories provided on Table 1 (2021 Weights). Relative importance of components in the Consumer Price Indexes: U.S. city average, December 2022 available at https://www.bls.gov/cpi/tables/relative-importance/2022.xlsx.

Predecessor: Data scrapers

4. Outlier detection methods.

Once data is collected, an outlier detection methods will be explored[xvii] and chosen to finalize the design. However, the raw data will always be available on a DSP and anyone that wants to apply a different method can do so.

Predecessor: Data scrapers, AI automated product classification program

5. Index calculation

The initial methodology will be similar to what Caballo and Bertolotto [2012][xviii] used to recreate Argentina's index. However, the data will be analyzed for fit, product availability/ index robustness, and the methodology will be adjusted as necessary. The methodology will be made public and the raw data will be available for anyone to inspect, recreate, or apply different methodology.

Predecessor: Data scrapers, AI automated product classification program, outlier detection program.

6. Saving aggregate indexes on-chain

Data reporters will run the aggregation program and report the index on chain.

Predecessor: Data scrapers, AI automated product classification program, outlier detection program, index calculation program, index data specification.

Future research for CPI:

- Supplement online index with individual data collection[xix]
- Develop World Index

Building a decentralized network of transparent statistics and surveys with minimal resources is a big ask. However, let's remember that in the 1940's when the US government had food rationing and price controls, they were able to enforce this by simply recruiting the people to do it for them[xx]. They provided them with a list of items and their official prices and had the people report businesses not adhering to the government mandate. People were incentivized because they didn't what to pay higher prices but ultimately increasing inflation and mismanagement of fiscal and monetary policy will have the same outcome.

[i] Not only was the beginning of the Bureau of Labor Statistics politicized but it was also a mirror of the prevalent discrimination and racism at the time. A more complete history can be found here: Darren Rippy, "The first hundred years of the Consumer Price Index: a methodological and political history," Monthly Labor Review, U.S. Bureau of Labor Statistics, April 2014, https://www.bls.gov/opub/mlr/2014/article/the-first-hundred-years-of-the-consumer-price-index.htm

[ii] Cavallo, Alberto and Bertolotto, Manuel, Filling the Gap in Argentina's Inflation Data (May 18, 2016). Available at SSRN: https://ssrn.com/abstract=2782104 or http://dx.doi.org/10.2139/ssrn.2782104

[iii] Nessi, H., Lo Blanco, M. (2023 May 12) "Argentina inflation smashes past every forecast to hit 109%." https://www.reuters.com/world/americas/country-beggars-argentines-reel-104-inflation-keeps-rising-2023-05-12/

[iv] Pozzebon, Stefano (2023 May 15) "Argentina raises interest rate to 97% as it struggles to tackle inflation" https://www.cnn.com/2023/05/15/business/argentina-interest-rates-inflation/index.html. CNN Business

[v] A more complete history of the Bureau of Labor Statistics and the CPI can be found in the Bureau of Labor Statistics timeline and Darren Rippy's MLR article on the history of the CPI:
Rippy, Darren, (2014 April) "The first hundred years of the Consumer Price Index: a methodological and political history". https://www.bls.gov/opub/mlr/2014/article/the-first-hundred-years-of-the-consumer-price-index.htm
Bureau of Labor Statistics. "Bureau of Labor Statistics Timeline" (2019 Apr 17)
https://www.bls.gov/bls/history/timeline.htm

[vi] A complete list of US Principal Federal Economic Indicators (PFEI) can be found on the annual release schedule for the US Government: Schedule of Release Dates for U.S. Principal Federal Economic Indicators for 2023, https://www.whitehouse.gov/wp-content/uploads/2022/09/pfei_schedule_release_dates_2023.pdf

[vii] To incentivize people and companies to participate on the survey and provide truthful information the Bureau of Labor Statistics protects respondents' privacy via the CIPSEA. This protection guarantees that the data provided will only be used for statistical purposes and not misused by other agencies, for example, the IRS to adjust a tax liability. More information can be found here:
Bureau of Labor Statistics. "Bureau of Labor Statistics Report to the Office of Management and Budget On Implementation of The Confidential Information Protection and Statistical Efficiency Act Calendar Year 2022", https://www.bls.gov/bls/cipsea-report.htm

[viii]Transparency International. "Corruption Perception Index" https://www.transparency.org/en/cpi/2022).

[ix] Both of the following studies showed a high correlation between online and offline prices:
Alberto Cavallo and Roberto Rigobon. The Billion Prices Project: Using Online Data for Measurement and Research. Journal of Economic Perspectives, (Forthcoming), 2016. https://www.aeaweb.org/articles?id=10.1257/jep.30.2.151
Alberto Cavallo. Online and official price indexes: Measuring Argentina's inflation. Journal of Monetary Economics, pages 152-165, 2013. URL
https://www.hbs.edu/ris/Publication%20Files/Cavallo_Alberto_Online%20and%20Official%20Price%20Indexes%20Measuring%20Argentinas%20Inflation_600c0e8f-cc57-430d-b869-a650dda2b290.pdf

[x] More information about MIT's Billion Prices projects can be found here: https://thebillionpricesproject.com/

[xi] Cavallo A. (2012 Oct 26) "Online and official price indexes: Measuring Argentina's inflation" Journal of Monetary Economics
https://www.hbs.edu/ris/Publication%20Files/Cavallo_Alberto_Online%20and%20Official%20Price%20Indexes%20Measuring%20Argentinas%20Inflation_600c0e8f-cc57-430d-b869-a650dda2b290.pdf

[xii] Cavallo A. (2012 Oct 26) "Online and official price indexes: Measuring Argentina's inflation" Journal of Monetary Economics
https://www.hbs.edu/ris/Publication%20Files/Cavallo_Alberto_Online%20and%20Official%20Price%20Indexes%20Measuring%20Argentinas%20Inflation_600c0e8f-cc57-430d-b869-a650dda2b290.pdf

[xiii] Report government assigned weights for the categories until enough data is available for independent weighting or further research on weighting without quantities is completed. For the US categories weight data can be found here: https://www.bls.gov/cpi/tables/relative-importance/2022.htm and differences in the index from the update here: https://www.bls.gov/cpi/tables/relative-importance/weight-update-information-2023.htm.

[xiv] For a global index, data from the World Bank or International Monetary Fund (IMF) can be used as a starting point and as a decentralized index is developed for each country, the government provided data will be substituted. The World Bank's global database of inflation is available here: https://www.worldbank.org/en/research/brief/inflation-database
Methodology for the global database of inflation is available here: https://thedocs.worldbank.org/en/doc/1ad246272dbbc437c74323719506aa0c-0350012021/related/WP-inflation-database.pdf.
The International Monetary Fund(IMF) also publishes inflation data by country here: https://www.imf.org/external/datamapper/datasets/WEO .
The IMF methodology can be found here: https://www.imf.org/-/media/Files/Data/CPI/cpi-manual-concepts-and-methods.ashx

[xv] "Both the CPI-U and C-CPI-U are indexes designed to measure price changes faced by urban consumers, while the CPI-W is designed to measure price changes faced by urban wage earners and clerical workers." Source: Bureau of Labor Statistics https://www.bls.gov/cpi/additional-resources/chained-cpi-questions-and-answers.htm#:~:text=Both%20the%20CPI%2DU%20and,wage%20earners%20and%20clerical%20workers.

[xvi] Tellor Data Specifications are saved on IPFS and they have information on how to submit it here: https://github.com/tellor-io/dataSpecs#for-tellor-users

[xvii] There is a lot of work on outlier detection methods but we'll want to analyze the data to settle on one method or group to implement. It was not clear what outlier methods are currently used on the CPI based on their website. They only mention "intervention analysis" for seasonally adjusted data series where they use X13ARIMA-SEATS to model and account for known distortions (e.g excise tax increase or oil embargo), and remove outliers and level shifts before calculating the seasonal adjustment factors (https://www.bls.gov/opub/hom/cpi/calculation.htm#calculation-of-seasonally-adjusted-indexes). Aside from exploring the CPI methodology (using X13ARIMA-SEATS) we will explore other methods. Here are some examples of articles written about existing outlier detection methods: https://wis.kuleuven.be/statdatascience/robust/papers/2011/rousseeuwhubert-robuststatisticsforoutlierdetectio.pdf, https://dataheroes.ai/blog/outlier-detection-methods-every-data-enthusiast-must-know/, https://towardsdatascience.com/outlier-detection-methods-in-machine-learning-1c8b7cca6cb8

[xviii] Cavallo A. (2012 Oct 26) "Online and official price indexes: Measuring Argentina's inflation" Journal of Monetary Economics
https://www.hbs.edu/ris/Publication%20Files/Cavallo_Alberto_Online%20and%20Official%20Price%20Indexes%20Measuring%20Argentinas%20Inflation_600c0e8f-cc57-430d-b869-a650dda2b290.pdf

[xix] Report response rates to determine if oversampling is necessary. For the US data can be found here: https://www.bls.gov/cpi/tables/response-rates/home.htm
Interview and daily diary forms households fill out for the US: https://www.bls.gov/cex/csxsurveyforms.htm

[xx] During the brief period that the Office of Price Administration existed to many women volunteered and were recruited to report deviations for controlled prices. More information can be found here: https://en.wikipedia.org/wiki/Office_of_Price_Administration#Women_and_the_OPA

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Bureau of Labor Statistics. Consumer Price Index. https://www.bls.gov/opub/hom/cpi/home.htm https://www.bls.gov/cpi/tables/relative-importance/2022.htm

Cavallo A. (2012 Oct 26) “Online and official price indexes: Measuring Argentina’s inflation” Journal of Monetary Economics https://www.hbs.edu/ris/Publication%20Files/Cavallo_Alberto_Online%20and%20Official%20Price%20Indexes%20Measuring%20Argentinas%20Inflation_600c0e8f-cc57-430d-b869-a650dda2b290.pdf

Cavallo, A., Bertolotto, M. (2016 May) “Filling the Gap in Argentina’s Inflation Data” http://www.thebillionpricesproject.com/wp-content/papers/FillingTheGap.pdf

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Darren Rippy, "The first hundred years of the Consumer Price Index: a methodological and political history," Monthly Labor Review, U.S. Bureau of Labor Statistics, April 2014, https://doi.org/10.21916/mlr.2014.13

Inflation recreated for Argentina and Venezuela. “Real Inflation Argentina” http://www.inflacionverdadera.com/argentina/english/

LeBau C. (2018 May 16) Citizens Are Not Fooled by Fake Statistics. UCLA Anderson Review https://anderson-review.ucla.edu/inflation-lies/

Nessi, H., Lo Blanco, M. (2023 May 12) “Argentina inflation smashes past every forecast to hit 109%.” https://www.reuters.com/world/americas/country-beggars-argentines-reel-104-inflation-keeps-rising-2023-05-12/

Pozzebon, Stefano (2023 May 15) “Argentina raises interest rate to 97% as it struggles to tackle inflation” https://www.cnn.com/2023/05/15/business/argentina-interest-rates-inflation/index.html. CNN Business

The Billion Prices Project Using Online Prices for Inflation and Research PowerPoint: https://bfi.uchicago.edu/wp-content/uploads/Cavallo-1.pdf