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Disinflations and income distribution

Laura Gómez-Acevedo and Marc Hofstetter*

Abstract

Most countries in the world have brought inflation down to very low rates. While there is broad consensus regarding the fact that policies aimed at bringing down inflation have adverse consequences on aggregate output and unemployment, at least in the short run, we know little about the distributional impact of disinflations. We find that along with disinflation, the income distribution tends to worsen: the Gini increases and the income share of those at the top of the income distribution significantly increases. We discuss the implications of these findings for monetary policy.

Keywords: Monetary Policy, Central Banks, Inflation, Disinflation, Income distribution.
JEL codes: E31, E32, E43, E52, E58, D31

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Desinflaciones y distribución de ingreso

Laura Gómez-Acevedo y Marc Hofstetter[†]

Resumen

La mayor parte del mundo ha bajado sus tasas de inflación a niveles muy bajos. Si bien hay consenso sobre los costos asociados a los procesos de reducción inflacionaria sobre el PIB o el desempleo, al menos en el corto plazo, sabemos poco sobre sus impactos distributivos. Mostramos que durante las desinflaciones la distribución de ingreso empeora: el Gini y la proporción del ingreso que va al decil más rico aumentan. Discutimos las implicaciones de nuestros resultados para la política monetaria

Palabras Clave: Política Monetaria, Banco Central, Inflación, Desinflación, Distribución de Ingreso.

Códigos JEL: E31, E32, E43, E52, E58, D31

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1. Introduction

In 1980, the world's median inflation rate was 13.8%. By the end of the century, the statistic had dropped to 4%, a figure that some scholars have recently proposed as an appropriate long-term inflation target (Blanchard et al., 2010; Ball, 2014). Nevertheless, the downward trend in world inflation did not stop at 4%; from 2013 onwards, more than half of the countries in the world have maintained inflation rates below 3%, while a third have maintained rates below 2%.¹

Big disinflations are usually triggered by Central Bank's tight policies and constitute the cleanest form of negative aggregate demand shocks (Blanchard, Cerutti and Summers, 2015). A large literature has shown that big disinflations, as defined below, reduce aggregate output (Ball 1994, 2009, 2014). This literature has quantified output losses relative to changes in inflation, and has studied the determinants of these losses.

While there is consensus around the fact that tight monetary policies aimed at reducing inflation rates generate *aggregate* output losses, we know little as to how these output sacrifices are distributed and whether they affect some portions of the population more than others. In line with this literature, our paper studies disinflations, but we do it with a focus on their distributive effects rather than their aggregate consequences.

Why would income distribution change during disinflations? Tight monetary policies in particular and disinflation in general can have distributive effects through several channels:²

- The proportion of labor and capital income is heterogeneous across households, with poorer households depending more on labor income. As long as monetary policies affect these sources of income in different ways, they will have an impact on income distribution.
- The risk of becoming unemployed during a downturn is also unevenly distributed: for instance, Elsby et al. (2010) document that during recessions, the unemployment rate of young or less educated individuals increases more than for other groups in the population.
- On the capital income side, the impact of monetary policies also has heterogeneous effects across the returns of different assets. Thus, monetary policies will affect the income

¹ International Monetary Fund, World Economic Outlook Database.

² See, for instance, Koedijk et al., 2018; and Nakajima, 2015.

distribution through this channel, inasmuch as households do not hold homogenous portfolios.

- The change in inflation itself can also have distributive consequences. Debtors tend to lose and creditors to benefit from (unexpected) lower inflation. This increases the real value of debts, potentially increasing inequality.
- Additionally, lower inflation could reduce the inflation tax, which could favor low income households that rely more on cash than richer households (Erosa and Ventura, 2002).
- Not all prices change at the same time nor in the same magnitude. Thus, the relative prices of goods and services change, and this can have distributive consequences.

Our contribution is also related to a recent branch of the literature that has studied the distributional consequences of monetary shocks *directly*. Several papers have found that contractionary monetary shocks lead to a deterioration in income distribution: Coibion et al. (2017) report this finding for the U.S., while Mumtaz and Theophilopoulou (2017) obtain similar conclusions for the U.K. Furceri et al. (2018) meanwhile corroborate the findings for a panel of 32 advanced and emerging countries, while Cantore et al. (2019), who study five developed economies, find that the share of output allocated to wages temporary increases following an episode of monetary tightening. In our paper, we do not rely on the identification of monetary shocks (as those papers do) to study their impact on distributional outcomes. Our units of analysis, as in the sacrifice ratio literature, are disinflation episodes.

In particular, we use Mazumder's (2014) global sample of disinflations running from 1960 through 2009 to analyze how income distribution changes when inflation is brought down. Disinflations in Mazumder's sample are identified following Ball's (1994) methodology: episodes where trend inflation falls between a peak and trough by at least 1.5 percentage points. Moreover, it considers only episodes with inflation peaks below 20%, where the trade-offs between inflation and aggregate economic activity have been found to be relevant.

Using a sample of disinflations rather than monetary shocks implies that our results do not hinge on estimated measures of monetary shocks (across countries and over time). This allows us to extend the study to a broader set of countries: papers relying on identifying monetary shocks require either long/high frequency data on economic expectations, or data that relies on narrative identification strategies (e.g., Romer and Romer, 2004), which are harder to come by.

Finally, looking directly at disinflations provides an important complement to the already existing literature: as stated before, it is a well-established fact that disinflations scar aggregate economic performance, but we know less about the distributive consequences, if any, of these episodes.

Since we look directly at episodes where inflation actually fell by a significant amount, our analysis does not incorporate any failed attempts by Central Banks to bring down inflation rates. If these failed attempts have consequences on income distribution, our results should be interpreted as the lower bound of actual effects. The reason for this will become clear once we explain our empirical strategy, which is based on Jorda's (2005) local projections methodology.

We find that during disinflations, Gini coefficients worsen, more so the longer the disinflations. The latter is consistent with the findings in the sacrifice ratio literature showing that long disinflations are associated with greater output losses (Mazumder, 2014; Smith and Senda, 2008). These results hold both when using market Gini indices (pre- tax and pre-transfers) or disposable indices (after taxes and transfers) in the estimations.

We also find that the share of income going to the richest decile and to the top 1% increase during disinflations. The size of the effects also increases with the length of a disinflation episode. These gains in participation are compensated by the loss of the first seven deciles of the distribution, especially those in the middle—that is, the 4th, 5th and 6th deciles.

In what follows, section 2 describes the data and section 3 the methodology, while section 4 reports the main result. The final section discusses the results, policy implications and tasks for future research.

2. Data

Disinflations: we use Mazumder's (2014) world sample of disinflations. He follows 189 countries over the period 1969 through 2009, and identifies disinflation episodes using Ball's (1994) method: he first finds peaks and troughs on trend inflations, and then identifies disinflations as episodes where inflation falls by at least 1.5 percentage points between a peak and trough. The upper limit for peaks is a 20% inflation rate.

157 out of the 189 countries in Mazumder's sample have had at least one disinflationary episode. He identifies 426 episodes, 78 of which were in OECD countries. The average length of an

episode is 4.6 years, which corresponds to an average of 5.6 years for the OECD sample and 4.4 for non-OECD disinflations.

Gini: we obtain the Gini coefficients from the Standardized World Income Inequality Database (SWIID 6.1; Solt, 2018). We estimate models with market income Gini coefficients (pre-taxes and pre-transfers) on the one hand, and disposable income Gini coefficients (after taxes and transfers), on the other.

The empirical strategy, described in the next section, requires both Gini coefficients alongside disinflations as well as non-disinflationary times. We collect all the Ginis available in SWIID for the countries included in Mazumder’s panel. These cover 54.4% of the disinflations. Table A1 in the Appendix 1 reports the descriptive statistics of the Gini indices.

Income shares: we obtain the shares of income from the World Inequality Database (WID). We use all the information available in the WID for the countries and years included in Mazumder’s panel. There are 70 complete episodes in the dataset, which are heavily concentrated in OECD countries; there are less than 9% complete non-OECD episodes. For this reason, when using income shares we only report the results for OECD countries (53.8% complete episodes).³ Table A2 in the Appendix 1 provides the descriptive statistics for the shares of income of each decile and for the top 1% of the OECD sample.

3. Methodology

We use an estimation strategy inspired by the local projections method (Jordà, 2005), with clustered standard errors. Other papers in the related literature, such as Coibion et al., (2017), and Furceri et al., (2017), also use variants of this methodology.

Our main regressions are as follows:

$$Y_{i,t+k} - Y_{i,t} = \alpha_i^k + \gamma_1^k trend_t + \sum_{j=1}^2 \gamma_{1+j} \Delta Y_{i,t-j} + \beta_k D_{i,t}^k + \varepsilon_{i,t}^k, \quad (1)$$

which we estimate for $k = 1, \dots, 6$.

³ We exclude the observations for which we do not have information for all deciles.

$Y_{i,t}$ is the income distribution measure (Gini or income share as described in the previous section) of country i in year t ; α_i^k is a country fixed effect; $trend_t$ is a linear trend; and $\Delta Y_{i,t-j}$ are lags for changes in the income distribution measure.

$D_{i,t}^k$ is a dummy variable equal to 1 *during* a disinflationary episode, and zero otherwise. $D_{i,t}^k$ depends on k : for $k = 1$, the dummy is turned on beginning with the peak period (0), through one year before the trough ($T-1$). In general, for an episode in country i with a peak in period 0 and a trough in period T , $D_{i,t}^k = 1$ for $t = 0$ up to $t = T - k$. The coefficient of interest is β_k . It represents the difference between two Y 's that are k periods apart within a disinflationary episode, relative to two Y 's, also k -periods apart, during non-disinflationary times. β_1 , for instance, represents the mean one-year change in Y within the disinflationary episodes relative to one-year changes in Y during non-disinflationary times.

Several clarifications are useful at this point. First, the β_k 's do not represent a standard impulse response function, because disinflations do not constitute one period shocks: the tight policies behind them usually last far longer than a single year. Thus, the chosen specification explores how Y changes while a disinflationary episode is under-way, relative to non-disinflationary periods.

Second, any failed attempts by Central Banks to bring inflation down are not identified as disinflationary episodes. If these attempts did have an effect on inequality, then our β_k 's would be underestimated as these periods would be in the comparison group.

Third, while k does not exactly represent the length of disinflationary episodes, the estimated effect for each k requires that an episode be at least k -years long. In this sense, the evolution of the β_k 's along k are a proxy for the impact of the duration of a disinflationary episode on income distribution.

Fourth, if disinflationary episodes affect the income distribution beyond the time of the trough (T), our coefficients would underestimate the actual changes in income distribution along disinflations. In that case, the related potential long-lasting outcomes would be part of the control group (under this terminology, changes in the income distribution during disinflations are the treatment group).

Fifth, following the practice of other papers, we estimate the specifications with two lags for changes in the income distribution measure. We have explored other lag specifications and the main results do not change. In the Appendix 2, we report several of these estimates.

Sixth, the fixed effect will capture any time invariant country specific characteristics that might explain the evolution of the income distribution. The time trend will absorb the general trend of the income distribution across countries. This general time trend and the country fixed effects might not be enough to capture episode specific characteristics or trends that are different across countries. It would be useful to control for other variables. However for a large sample like ours covering most countries in the world over fifty years, it is challenging to find data for control variables.

To deal with these concerns, we follow a twofold strategy. On the one hand, in the Appendix 3, we report results including country specific time trends in the estimates. The disadvantage of the latter specification is that it is very demanding in terms of parameters to be estimated and collinearity issues kick in some estimations. The results, in any case, are very similar.

On the other hand, we follow a strategy that the Local Projections literature has used to control for episode specific characteristics, that is, is to include the *level* of the contemporaneous dependent variable as an additional regressor (e.g., Jordà et al. 2013). Again, this does not change our main results. We report them in Appendix 4.

Finally, the main specification aims at estimating how the income distribution evolves during disinflationary times relative to non-disinflationary periods. There could be concerns about reverse causality: changes in the income distribution generating disinflations. One channel producing this outcome is the following: rising inequality could reduce aggregate demand because those at the top of the wealth distribution tend to consume a smaller share of their income than those at the bottom. This could *cause* the disinflation. This, while theoretically possible, looks unlikely. On the one hand, large disinflationary episodes are mostly the consequence of monetary policies aimed at producing lower inflation rates (e.g. Ball, 1994; Hofstetter, 2008). On the other hand, it is very unlikely that changes in income distributions are rapid and strong enough to produce such sizeable disinflationary processes. As we emphasize later in the conclusions, the issue deserves, in any case, the attention of future research.

4. Results

In this and the next section we focus on describing the main outcomes and making sure we clarify the way the coefficients are to be interpreted. We leave most of the discussion and broader interpretation of the results to the final section of the paper.

Gini: market income

The β_k 's represent the change in Gini coefficients that are k years apart within a disinflationary episode, relative to the same kinds of changes during non-disinflationary periods. In Figure 1, we plot the β_k 's, along with 90% confidence intervals. The plot on the left reports the results for the whole sample; the other two plots report the effects for OECD countries and non-OECD countries, respectively. The latter two are estimated using equation 1, and include an extra interaction to estimate the differential effects over the two sets of countries.

Figure 1. β_k for Y = Gini coefficients –red/continuous for Market Income and blue/dashed for Disposable Income. The results are based on estimations of equation 1: the plots report β_k (vertical axes) for different k 's (horizontal axes), along with 90% confidence intervals. The β_k 's represent the change in Gini coefficients k periods apart within a disinflationary episode relative to the same kinds of changes during non-disinflationary periods.

For the *whole* sample, the Gini coefficients deteriorate within disinflationary episodes, and do so in an increasing manner as k increases. The statistical relevance also increases with k . The sacrifice ratio literature—which studies the output losses per point of inflation during disinflationary episodes—has established that long disinflationary episodes tend to be more costly.⁴ The fact that the β_k 's are increasing over k suggests that the adverse effects on income

⁴ Many papers use the speed (the number of inflation points per year) of an episode as a determinant rather than the length of the episode. Nevertheless, an episode's length has been shown to positively affect sacrifice ratios on its own (e.g. Hofstetter 2008; Mazumder, 2014; and Smith and Senda, 2009).

distribution are also a positive function of the length of a disinflationary episode, in the manner discussed in the previous section.

What do the coefficients mean quantitatively? In Table 1, we report the β_k 's, along with their ratios relative to the standard deviation (σ) and the mean (μ) of the respective Gini coefficients in the sample. Take for instance β_5 —the five-year changes in the Gini indices during a disinflationary episode, relative to the five-year changes during non-disinflationary periods. The coefficient is 0.55, which corresponds to an increase in the Gini of 8.2% relative to its standard deviation, or 1.2% relative to the Gini's sample mean. If we look at β_6 , the increase in the Gini during the disinflationary episode reaches 11.5% of its standard deviation, or 1.7% of its mean.

Market Gini									
Complete Sample			Non-OECD			OECD			
k	β	β/σ	β/μ	β	β/σ	β/μ	β	β/σ	β/μ
1	0.028	0.4	0.1	0.008	0.1	0.0	0.059*	1.1	0.1
2	0.086*	1.3	0.2	0.021	0.3	0.0	0.186**	3.4	0.4
3	0.179**	2.6	0.4	0.064	0.9	0.1	0.333***	6.1	0.7
4	0.354***	5.2	0.8	0.196	2.7	0.4	0.533***	9.8	1.2
5	0.550***	8.2	1.2	0.368	5.1	0.8	0.735***	13.4	1.7
6	0.777***	11.5	1.7	0.587	8.2	1.3	0.959***	17.6	2.2

Disposable Gini									
Complete Sample			Non-OECD			OECD			
k	β	β/σ	β/μ	β	β/σ	β/μ	β	β/σ	β/μ
1	0.017	0.2	0.0	0.012	0.2	0.0	0.025	0.4	0.1
2	0.054	0.6	0.1	0.037	0.5	0.1	0.078	1.1	0.3
3	0.123	1.4	0.3	0.101	1.4	0.2	0.151	2.2	0.5
4	0.259**	2.9	0.7	0.238	3.2	0.6	0.287	4.1	1.0
5	0.453**	5.0	1.2	0.444	5.9	1.1	0.462**	6.7	1.5
6	0.677***	7.5	1.8	0.690	9.2	1.7	0.665**	9.6	2.2

Table 1. β_k for $Y = \text{Gini}$. Results based on estimations of equation 1. The β_k 's represent the change in Gini's k periods apart within a disinflationary episode, relative to the same change during non-disinflationary periods. σ and μ correspond to the standard deviation and the mean of the respective Gini coefficients (ratios reported in percentage terms). *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

The results for OECD and non OECD countries are also reported in Figure 1 and Table 1. While the coefficients in the two samples follow similar patterns, the effects are stronger and only statistically relevant for the OECD countries. The effects for the OECD countries are larger than the ones for all countries. For instance, for $k = 5$, the coefficient implies an increase in Gini

corresponding to 13.4% of its standard deviation, or 1.7% of its mean. For $k = 6$, this figure climbs to 17.6% and 2.2%, respectively.

Mazumder (2014) shows that the sacrifice ratios—that is, the output losses per inflation point during a disinflationary episode—are on average smaller for non-OECD countries: the OECD figure is 1.15, while the mean for non-OECD countries is 0.48. Finding, as we do, that the deterioration in the income distribution is particularly significant in the OECD case then is consistent with Mazumder’s findings. The distributional effects we identify go hand in hand with the size of the recessions estimated by Muzumder.

Summing up then, we find that the market Gini coefficients deteriorate during disinflationary episodes, more so the longer the episode, and that the results are significant for the whole sample, and for OECD countries.

Market Income shares (deciles)

Provided that the income distribution worsens, as in the results discussed above, the question becomes, which deciles gain or lose participation in the national income during disinflationary episodes? We use the same empirical strategy described in equation 1, only now with Y corresponding to the income share of each decile of the population instead of the Gini. We do this for OECD countries only, as the data for non-OECD covers less than 10% of disinflationary episodes. We report the estimates for $k = 1$ through 6 in Figure 2.

The income participation of the top decile increases over the course of disinflationary episodes, for all k ’s. This is the only decile that gains in terms of participation in the national income during disinflationary episodes. If the upper decile’s participation in the national income increases, it must be the case that the other deciles decrease. For all k ’s, the first seven deciles have negative coefficients, meaning that all of them decline in participation in the national income during disinflationary episodes. These coefficients are statistically relevant for deciles 4, 5 and 6.

Summing up, income distribution deteriorates over the course of a disinflationary episode, and this deterioration can be explained by a gain in the participation of the richest decile in the national income at the expense of the middle class. As with the Gini, the size of the coefficients (in absolute terms) rises with k . Again, inasmuch as k works as a proxy for the length of an

episode, as discussed earlier, it appears that the consequences for different deciles are also a positive function of how long a disinflationary episode lasts.

Figure 2. β_k , where Y = Income shares for each decile of the population—red/solid for Market Income and blue/dashed for Disposable Income. The results are based on estimations of equation 1 for OECD countries. The plots report β_k (vertical axes) for different deciles (horizontal axes) along with 90% confidence intervals. The β_k 's represent the change in the income participation of each decile, k periods apart within a disinflationary episode relative to the same change during non-disinflationary periods.

How big are these effects? In Table 2 we report for each decile the β_k 's, along with their ratio relative to the respective standard deviation and mean of the income share (which also vary by decile). The figures we obtain are large. The biggest gain in participation corresponds to the upper decile, and for $k = 6$. The coefficient implies a 21% gain relative to its standard deviation, and a 5% gain relative to its mean. As for the loss of participation, the largest estimate is for the 4th decile, for the $k = 6$ case. It signals a loss corresponding to 23% relative to its standard deviation. With respect to its mean, the coefficient implies a loss of participation in the national income of 3.7%. In the final section of the paper we take stock of the results and discuss the implications.

		$k = 1$						$k = 2$					
		Pre-Tax			After-Tax			Pre-Tax			After-Tax		
		β	β/σ	β/μ	β	β/σ	β/μ	β	β/σ	β/μ	β	β/σ	β/μ
Deciles	1	-0.0001	-1.6	-0.7	0.00021	1.8	0.9	-0.0002	-2.4	-1.1	0.00026	2.2	1.1
	2	-0.0002	-1.9	-0.5	-0.0003*	-2.8	-0.6	-0.0003	-3.1	-0.8	-0.0005	-4.9	-1.1
	3	-0.0002	-2.2	-0.5	-0.0002*	-2.7	-0.4	-0.0004	-4.1	-0.8	-0.0004*	-4.8	-0.7
	4	-0.0002*	-2.4	-0.4	-0.0002*	-2.8	-0.3	-0.0004*	-4.7	-0.8	-0.0003*	-4.8	-0.5
	5	-0.0002**	-2.4	-0.3	-0.0002*	-3.6	-0.3	-0.0004**	-4.7	-0.6	-0.0004*	-6.0	-0.5
	6	-0.0001*	-1.7	-0.2	-0.0002**	-4.8	-0.3	-0.0003**	-4.2	-0.4	-0.0004**	-8.3	-0.5
	7	-0.0000	-1.1	-0.1	-0.0002	-4.8	-0.2	-0.0002	-3.0	-0.2	-0.0003	-8.0	-0.4
	8	0.00000	0.1	0.0	-0.0001	-3.5	-0.1	-0.0000	-0.4	0.0	-0.0002	-5.4	-0.2
	9	0.00002	0.3	0.0	0.00003	0.3	0.0	0.00011	1.2	0.1	0.00007	0.7	0.1
	10	0.00143**	2.1	0.5	0.00146*	3.2	0.6	0.00290*	4.3	1.0	0.00253	5.5	1.0
		$k = 3$						$k = 4$					
		Pre-Tax			After-Tax			Pre-Tax			After-Tax		
		β	β/σ	β/μ	β	β/σ	β/μ	β	β/σ	β/μ	β	β/σ	β/μ
Deciles	1	-0.0005	-4.5	-2.1	0.00018	1.5	0.8	-0.0010	-8.8	-4.1	0.00030	2.5	1.3
	2	-0.0006	-5.2	-1.4	-0.0008	-8.1	-1.8	-0.0010	-9.0	-2.4	-0.0011	-10.9	-2.4
	3	-0.0007	-6.7	-1.4	-0.0006*	-7.4	-1.1	-0.0012	-11.0	-2.2	-0.0008*	-9.5	-1.4
	4	-0.0008*	-7.7	-1.2	-0.0005**	-7.3	-0.8	-0.0012*	-12.2	-2.0	-0.0007**	-9.7	-1.1
	5	-0.0007**	-7.8	-1.0	-0.0006**	-9.3	-0.8	-0.0012**	-12.4	-1.6	-0.0009**	-13.0	-1.1
	6	-0.0006**	-7.4	-0.8	-0.0007**	-12.4	-0.8	-0.0010**	-11.9	-1.2	-0.0009**	-17.1	-1.1
	7	-0.0004	-5.5	-0.5	-0.0005	-10.8	-0.5	-0.0006	-8.0	-0.7	-0.0007	-15.5	-0.7
	8	-0.0000	-1.2	-0.1	-0.0003	-7.4	-0.3	-0.0000	-0.9	-0.1	-0.0004	-9.8	-0.4
	9	0.00021	2.1	0.1	0.00018	1.8	0.1	0.00049	5.1	0.3	0.00019	1.9	0.1
	10	0.00470*	6.9	1.6	0.00406*	8.8	1.6	0.00746*	11.0	2.6	0.00598*	13.0	2.3
		$k = 4$						$k = 5$					
		Pre-Tax			After-Tax			Pre-Tax			After-Tax		
		β	β/σ	β/μ	β	β/σ	β/μ	β	β/σ	β/μ	β	β/σ	β/μ
Deciles	1	-0.0017	-14.9	-6.9	-0.0000	-0.3	-0.2	-0.0030	-25.7	-11.9	-0.0010	-8.3	-4.2
	2	-0.0015	-13.1	-3.4	-0.0013	-13.0	-2.9	-0.0025	-22.5	-5.9	-0.0025	-23.9	-5.3
	3	-0.0016	-15.4	-3.1	-0.0009	-10.6	-1.5	-0.0026	-23.8	-4.8	-0.0015	-17.1	-2.5
	4	-0.0016*	-16.1	-2.6	-0.0008*	-11.1	-1.2	-0.0024*	-23.2	-3.7	-0.0011	-14.3	-1.6
	5	-0.0016**	-16.7	-2.2	-0.0010*	-15.6	-1.3	-0.0021*	-22.0	-2.8	-0.0013	-19.5	-1.7
	6	-0.0014**	-15.6	-1.6	-0.0012*	-20.9	-1.3	-0.0016**	-18.1	-1.9	-0.0014	-24.7	-1.6
	7	-0.0008*	-10.1	-0.8	-0.0010	-21.6	-1.0	-0.0009*	-11.6	-1.0	-0.0012	-26.5	-1.2
	8	0.00005	0.7	0.0	-0.0006	-13.9	-0.6	0.00020	2.6	0.2	-0.0007	-16.1	-0.7
	9	0.00100	10.2	0.7	0.00044	4.4	0.3	0.00170	17.4	1.2	0.00124	12.1	0.9
	10	0.01034*	15.2	3.6	0.00774*	16.8	3.0	0.01453*	21.3	5.0	0.01073*	23.3	4.1

Table 2. β_k where Y = income shares for each decile of the population. The results are based on estimations of equation 1 for OECD countries. The β_k 's represent changes in income participation for each decile, k periods apart during a disinflationary episode, relative to the same change during non-disinflationary periods. σ and the μ correspond to the standard deviation and the mean of income shares for respective deciles (ratios reported in percentage terms).*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Market Income share: what about the top 1%?

The top centile of the income distribution has received a lot of attention by scholars and media over the last few years (e.g., Alvaredo et al., 2013). We estimate equation 1 as in the previous section for income deciles, only now in order to analyze how the participation of the top 1% changes over the course of disinflationary episodes. In Figure 3, we report the β_k 's for the top centile of the income distribution (for OECD countries only); in Table 3, in addition to the β_k 's, we report their ratios relative to the standard deviation and the mean of the top centile's distribution.

Figure 3. β_k , where $Y = \text{Income share of the Top 1\%}$ —red/continuous for Market Income and blue/dashed for Disposable based on estimations of equation 1 for OECD countries. The plots report β_k (vertical axes) for different k 's along with 90% confidence intervals. The β_k 's represent the change in the income share of the top 1%, k periods apart during a disinflationary episode relative to the same change during non-disinflationary periods.

The participation of the top 1% increases for all k 's during disinflationary episodes. Not only are the results statistically relevant, they are also economically important: the size of the β_k relative to the mean (of the top 1% of participation) starts at a 1.1% increase for $k = 1$, and climb to 8.5% for $k = 6$. The latter is much larger than the figure we estimated for the top decile (5%).

	Market			Disposable		
k	β	β/σ	β/μ	β	β/σ	β/μ
1	0.001**	2.3	1.1	0.001	2.7	1.0
2	0.002*	4.2	2.0	0.001	4.0	1.4
3	0.002*	6.1	2.9	0.001	5.7	2.0
4	0.004**	9.6	4.5	0.003	10.2	3.6
5	0.004**	13.5	6.4	0.004	14.7	5.2
6	0.007**	18.0	8.5	0.004	18.5	6.6

Table 3. β_k where Y = share of the Top 1%. The results are based on estimations of equation 1 for OECD countries. The β_k 's represent the change in the income participation of the top 1%, k periods apart during a disinflationary episode, relative to the same change during non-disinflationary periods. σ and the μ correspond to the standard deviation and the mean of the top 1% (ratios reported in percentage terms).*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Disposable income

The discussion so far has focused on market income indices. Of course, it could be the case that during disinflations the income distribution before taxes and transfers deteriorates, but these effects are washed out by fiscal policy, precisely through taxes and transfers. Figures and Tables 1 through 3 also include the results of estimating equation 1 with disposable income measures, i.e., after taxes and transfers.

Most of the outcomes are similar to the baseline case: there is a significant effect on income distribution during disinflationary episodes, one that grows as time goes on between the analyzed two periods. More precisely, the income Gini coefficients worsen during disinflations and the income share of the top decile increases at the expense of the middle class. The only case where there is an obvious difference is in the estimates of the top 1%. Here, while the coefficients are still positive suggesting that they gain income share, they are statistically insignificant. This result suggests that the gains in income share of the top 1% during disinflations are attenuated by tax policies.

Summing up then, the potential countercyclical role of fiscal policy is not enough to avoid the adverse consequences on income distribution that occur during disinflations: even after accounting for the role of taxes and transfers, the Gini increases, and the income share of the top decile increases at the expense of the middle class. In a nutshell, disinflations scar income distribution even after accounting for the government's role in redistributing resources.

5. Conclusions and discussion

We study the link between disinflations and income distribution. Disinflationary episodes are generally triggered by monetary policy actions that cool off aggregate economic activity. While there seems to be a consensus that tight monetary policies reduce economic activity, at least in the short-run, the distributional consequences of these episodes have not received as much attention in the literature. Only recently have some papers identified the evolution of income distribution variables following monetary policy shocks (e.g. Coibion et al., 2017; Mumtaz and Theophilopoulou, 2017; and Furceri et al., 2018).

Our unit of analysis are disinflations—our paper does not rely on the identification of monetary shocks. We use a global sample of disinflationary episodes, running from 1969 to 2009, for 189 countries (Mazumder, 2014). We find that within disinflationary episodes, the market income Gini indices deteriorate: after five (six) years into a disinflationary episode, the Gini coefficients increase by 8.2% (11.5%) relative to its standard deviation, which corresponds to 1.2% (1.7%) of its mean. The effect is stronger for OECD disinflations than for non-OECD disinflations.

Our results also show that long disinflationary episodes have stronger effects on Gini coefficients than short ones. As in the sacrifice ratio literature, the collateral damages of disinflations get worse the longer the episode.

When we estimate our models with disposable income Gini (after taxes and transfers), we find that fiscal policy attenuates the consequences on income distribution, but these measures nonetheless deteriorate during disinflationary episodes.

For OECD countries only, we estimate how the participation of different population deciles in income changes during disinflationary episodes. The results point to a strong gain in participation by the upper decile of the income distribution. For instance, after five (six) years into a disinflationary episode, the upper decile's participation in income increases by 3.6% (5.0%) relative to its mean. The middle class—fourth to sixth deciles—meanwhile sees a decrease in participation in income in a statistically significant manner. The results are similar with disposable income shares.

We also study how the participation of the top 1% in the income distribution changes during disinflationary episodes. We find that it rises notably: relative to its mean, the increase of the top

1% in participation in income during a disinflationary episode is as high as 8.5%. This outcome, though, is only statistically relevant with market income shares.

There is a broad consensus around the fact that there is a significant amount of output sacrificed during disinflations (Ball, 1994; Mazumder, 2014; Romer and Romer, 2004; and Jordá et al., 2020). Our results point to the fact that these losses are not evenly distributed: the Gini worsens during disinflationary episodes and the top decile increase their participation in income at the expense of the middle class.

Bringing down inflation has often been advertised as a policy aimed at protecting the poor, the reasoning being that they are the ones least able to protect themselves from price increases. Our results, however, suggest that the *process* of bringing inflation down benefits the richest portions of the population and hurts the most the middle class. Of course, the results do not mean that low inflation, once achieved, hurts these classes.

It is in the hands of Central Banks and the mandates societies give them to balance goals with the side-effects of the policies needed to achieve them. Our results argue against having Central Banks with single mandates focusing exclusively on price stability, where output losses and their distributive implications can be ignored. Voinea and Monnin (2017) point out that securing a fair distribution of the benefits and costs of price stability is a public good. The same could be argued with respect to disinflationary episodes.

Throughout the paper, we have interpreted the results as evidence that disinflations, often triggered by Central Banks' policies, cause economic activity to deteriorate, in a manner that is unevenly distributed across a population's income. There is, of course, the possibility of reverse causality: rising inequality could reduce aggregate demand, because those at the top of the wealth distribution tend to consume a smaller share of their income than those at the bottom. This could *cause* the disinflation. Nevertheless, Ball (1994) and Hofstetter (2008) show that large disinflationary episodes, as the ones examined in this paper, are mostly the consequence of monetary policies aimed at producing lower inflation rates. Moreover, it looks unlikely that we will observe changes in income distributions rapid and strong enough to produce such sizeable disinflationary processes. Nonetheless, the issue remains an interesting one for future study.

Another open question for future research is whether these redistributive effects average out over a business cycle. What we show here is that during a disinflationary episode, the distribution deteriorates. It may be that, at times of stable or rising inflation, these effects are the reverse. One related piece of evidence suggests that this is not likely the case: Furceri et al. (2018) show that the effects of contractionary monetary shocks on income distribution are stronger than those of expansionary shocks. Future research should look at the long-run consequences of disinflationary episodes on income distribution in order to shed light on this important issue.

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Appendix 1: Descriptive statistics

Table A1. Mean (μ) and standard deviations (σ) of market and disposable income Gini Indices.

	Complete Sample				Non-OECD				OECD			
	Market		Disposable		Market		Disposable		Market		Disposable	
	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ
1969-1979	43.9	6.9	36.8	9.5	42.2	5.5	29.5	7.6	45.2	7.5	42.0	7.1
1980-1980	44.4	7.1	36.8	9.6	42.8	5.2	28.9	6.9	45.4	7.9	41.5	7.7
1990-1999	45.6	6.7	38.4	9.1	45.0	5.3	30.1	7.1	45.8	7.1	41.4	7.7
2000-2009	46.2	6.4	39.3	8.3	46.8	4.7	30.9	6.1	46.0	6.8	41.5	7.4
1969-2009	45.4	6.8	38.2	9.0	44.4	5.5	29.9	6.9	45.7	7.2	41.5	7.5

Table A2. Mean (μ) and standard deviations (σ) for the shares of income of each decile and for the top 1%. OECD countries.

	Decile 1 (poorest)				Decile 2				Decile 3				Decile 4			
	Pre-Tax		After-Tax		Pre-Tax		After-Tax		Pre-Tax		After-Tax		Pre-Tax		After-Tax	
	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ
1969-1979	0.01	0.00	0.02	0.00	0.03	0.00	0.04	0.00	0.04	0.00	0.05	0.00	0.06	0.00	0.06	0.00
1980-1980	0.03	0.02	0.03	0.01	0.05	0.01	0.05	0.01	0.06	0.01	0.06	0.01	0.07	0.01	0.07	0.01
1990-1999	0.03	0.01	0.02	0.01	0.04	0.01	0.05	0.01	0.05	0.01	0.06	0.01	0.06	0.01	0.07	0.01
2000-2009	0.02	0.01	0.02	0.01	0.04	0.01	0.05	0.01	0.05	0.01	0.06	0.01	0.06	0.01	0.07	0.01
1969-2009	0.03	0.01	0.02	0.01	0.04	0.01	0.05	0.01	0.05	0.01	0.06	0.01	0.06	0.01	0.07	0.01

	Decile 5				Decile 6				Decile 7				Decile 8			
	Pre-Tax		After-Tax		Pre-Tax		After-Tax		Pre-Tax		After-Tax		Pre-Tax		After-Tax	
	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ
1969-1979	0.07	0.00	0.08	0.00	0.08	0.00	0.09	0.00	0.10	0.00	0.10	0.00	0.12	0.00	0.10	0.00
1980-1980	0.08	0.01	0.08	0.01	0.09	0.01	0.09	0.01	0.10	0.00	0.11	0.00	0.12	0.00	0.11	0.00
1990-1999	0.07	0.01	0.08	0.01	0.09	0.01	0.09	0.01	0.10	0.01	0.10	0.00	0.12	0.01	0.10	0.00
2000-2009	0.07	0.01	0.08	0.01	0.08	0.01	0.09	0.01	0.10	0.01	0.10	0.00	0.11	0.01	0.10	0.00
1969-2009	0.08	0.01	0.08	0.01	0.09	0.01	0.09	0.01	0.10	0.01	0.10	0.00	0.12	0.01	0.10	0.00

	Decile 9				Decile 10 (richest)				Top 1%			
	Pre-Tax		After-Tax		Pre-Tax		After-Tax		Pre-Tax		After-Tax	
	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ
1969-1979	0.15	0.00	0.14	0.00	0.34	0.01	0.30	0.00	0.10	0.01	0.09	0.00
1980-1980	0.14	0.01	0.14	0.01	0.25	0.05	0.24	0.05	0.06	0.02	0.06	0.02
1990-1999	0.14	0.01	0.14	0.01	0.29	0.08	0.26	0.04	0.08	0.05	0.07	0.02
2000-2009	0.14	0.01	0.14	0.01	0.31	0.06	0.28	0.04	0.09	0.04	0.08	0.02
1969-2009	0.14	0.01	0.14	0.01	0.29	0.07	0.26	0.05	0.08	0.04	0.07	0.02

Appendix 2. The lags.

In the baseline results we estimated equation (1) using two lags, following the practice of most papers in the related literature. Here we report the main outcomes for market and disposable income measures if we use one and three lags. We also checked the number of lags suggested by BIC and AIC criteria. Of course, the number can change across regressions but in 85% of the cases both criteria suggested between one and three lags.

1 lag:

Figure A1. β_k for Y = Market and Disposable income Gini for 1 lag. The results are based on estimations of equation 1 for the whole sample: the plots report β_k (vertical axes) for different k 's (horizontal axes), along with 90% confidence intervals. The β_k 's represent the change in Gini coefficients k periods apart within a disinflationary episode relative to the same kinds of changes during non-disinflationary periods. Mean and standard deviations of market and disposable income Gini Indices.

Figure A2. β_k , for $Y = \text{Market and Disposable income shares for each decile of the population for 1 lag}$. The results are based on estimations of equation 1 for OECD countries. The plots report β_k (vertical axes) for different deciles (horizontal axes) along with 90% confidence intervals. The β_k 's represent the change in the income participation of each decile, k periods apart within a disinflationary episode relative to the same change during non-disinflationary periods

Figure A3. β_k , where $Y = \text{Market and Disposable Income share of the Top 1% for 1 lag}$. The results are based on estimations of equation 1 for OECD countries. The plots report β_k (vertical axes) for different k 's along with 90% confidence intervals. The β_k 's represent the change in the income share of the top 1%, k periods apart during a disinflationary episode relative to the same change during non-disinflationary periods.

3 lags:

Figure A4. β_k for Y = Market and Disposable income Gini for 3 lags. The results are based on estimations of equation 1 for the whole sample: the plots report β_k (vertical axes) for different k's (horizontal axes), along with 90% confidence intervals. The β_k 's represent the change in Gini coefficients k periods apart within a disinflationary episode relative to the same kinds of changes during non-disinflationary periods Mean and standard deviations of market and disposable income Gini Indices.

Figure A5. β_k , for Y = Market and Disposable income shares for each decile of the population for 3 lags. The results are based on estimations of equation 1 for OECD countries. The plots report β_k (vertical axes) for different deciles (horizontal axes) along with 90% confidence intervals. The β_k 's represent the change in the income participation of each decile, k periods apart within a disinflationary episode relative to the same change during non-disinflationary periods

Figure A6. β_k , where $Y = \text{Market and Disposable Income share of the Top 1\% for 3 lags}$. The results are based on estimations of equation 1 for OECD countries. The plots report β_k (vertical axes) for different k 's along with 90% confidence intervals. The β_k 's represent the change in the income share of the top 1%, k periods apart during a disinflationary episode relative to the same change during non-disinflationary periods.

Appendix 3. Country specific time trends

Figure A7. β_k for $Y = \text{Market and Disposable income Gini}$ with country specific time trends. The results are based on estimations of equation 1 for the whole sample: the plots report β_k (vertical axes) for different k 's (horizontal axes), along with 90% confidence intervals. The β_k 's represent the change in Gini coefficients k periods apart within a disinflationary episode relative to the same kinds of changes during non-disinflationary periods Mean and standard deviations of market and disposable income Gini Indices.

Figure A8. β_k , for Y = Market and Disposable income shares for each decile of the population with country specific time trends. The results are based on estimations of equation 1 for OECD countries. The plots report β_k (vertical axes) for different deciles (horizontal axes) along with 90% confidence intervals. The β_k 's represent the change in the income participation of each decile, k periods apart within a disinflationary episode relative to the same change during non-disinflationary periods

Figure A9. β_k , where Y = Market and Disposable Income share of the Top 1% with country specific time trends. The results are based on estimations of equation 1 for OECD countries. The plots report β_k (vertical axes) for different k's along with 90% confidence intervals. The β_k 's represent the change in the income share of the top 1%, k periods apart during a disinflationary episode relative to the same change during non-disinflationary periods.

Appendix 4. Controlling for the contemporaneous level of Gini or Share.

Figure A10. β_k for $Y = \text{Market}$ and Disposable income Gini controlling for the contemporaneous Gini.

The results are based on estimations of equation 1 for the whole sample: the plots report β_k (vertical axes) for different k 's (horizontal axes), along with 90% confidence intervals. The β_k 's represent the change in Gini coefficients k periods apart within a disinflationary episode relative to the same kinds of changes during non-disinflationary periods. Mean and standard deviations of market and disposable income Gini Indices.

Figure A11. β_k , for $Y = \text{Market}$ and Disposable income shares for each decile of the population with country specific time trends controlling for the contemporaneous share. The results are based on estimations of equation 1 for OECD countries. The plots report β_k (vertical axes) for different deciles (horizontal axes) along with 90% confidence intervals. The β_k 's represent the change in the income participation of each decile, k periods apart within a disinflationary episode relative to the same change during non-disinflationary periods

Figure A12. β_k , where $Y = \text{Market and Disposable Income share of the Top 1\% with country specific time trends controlling for the contemporaneous share}$. The results are based on estimations of equation 1 for OECD countries. The plots report β_k (vertical axes) for different k 's along with 90% confidence intervals. The β_k 's represent the change in the income share of the top 1%, k periods apart during a disinflationary episode relative to the same change during non-disinflationary periods.