The effect of imported inflation and central bank credibility on the poor and rich

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Abstract

This paper analyzes two phenomena regarding the inflation of the poor and rich. Firstly, we analyze whether the harmful effect of imported inflation is higher for the poor than the rich. Secondly, assuming that central bank credibility helps keep inflation under control and that the poor are more susceptible to the damaging effect of the inflation tax, we evaluate whether the credibility is more beneficial to the poor. Based on data from the Brazilian economy, the findings indicate a higher effect of imported inflation on food inflation and poor households. In contrast, credibility effectively reduces inflation for the poor.

Keywords: imported inflation; inflation of poor and rich; central bank credibility.

JEL classification: E31, E64, E58.

Resumo

Este artigo analisa dois fenômenos em relação à inflação dos pobres e dos ricos. Em primeiro lugar, analisamos se o efeito nocivo da inflação importada é mais elevado para os pobres do que para os ricos. Em segundo lugar, assumindo que a credibilidade do banco central ajuda a manter a inflação sob controle e que os pobres são mais suscetíveis ao efeito nocivo do imposto inflacionário, avaliamos se a credibilidade é mais benéfica para os pobres. Com base em dados da economia brasileira, os resultados indicam um efeito mais elevado da inflação importada sobre a inflação alimentar e as famílias pobres. Em contrapartida, a credibilidade reduz efetivamente a inflação para os pobres.

Palavras-chave: inflação importada; inflação de pobres e ricos; credibilidade do banco central.

Área 4 - Macroeconomia, Economia Monetária e Finanças

1. Introduction

Globalization increases the possibility of contagion effect between economies (Forbes, 2019; Broner and Ventura, 2016; Kose et al., 2010). In particular, imported inflation plays an essential role in explaining domestic inflation (Albuquerque and Baumann, 2017; Szafranek, 2017; Matheson and Stavrev, 2013).[1] Because emerging economies are vulnerable to external shocks, it is reasonable to consider that the impact of imported inflation is more relevant to explain domestic inflation in these economies (Almansour et al., 2015; Akinci, 2013; Erten, 2012). Furthermore, as recognized by international institutions such as the Food and Agriculture Organization of the United Nations, food security and access to basic nutrition is a current challenge (FAO et al., 2021). Therefore, one relevant question is to analyze the effect of imported inflation on food inflation. Moreover, if we observe a significant impact of imported inflation on food inflation, it is possible to conjecture a difference of this effect on poor and rich, since poorer households proportionally spend a larger share of their income on food (Ha, Kose, and Ohnsorge, 2019; Holtemöller and Mallick, 2016). In addition, it is well-known that central banks play a relevant role in keeping inflation under control and that central bank credibility is a useful tool for this purpose (de Mendonça, 2018; Montes, 2013; Tanuwidjaja and Choy, 2006). Furthermore, "rich are better able to protect themselves against, or benefit from, the effects of inflation than are the poor" (Easterly and Fischer, 2001, 160). Hence, the central bank's success in keeping inflation under control can benefit the poorest households.

Using data from the Brazilian economy, we investigate the effect of two phenomena on inflation of the poor and rich. Firstly, based on the idea that imported inflation is a source for inflation and the effect of inflation is different on poor and rich, we analyze whether the effect of imported inflation on domestic inflation is higher for low-income households than high-income households. Specifically, we analyze whether the increase in imported inflation has a greater impact on food inflation than headline inflation. Based on the perspective that an increase in food inflation has a higher impact on lower purchasing power households, we conjecture that the effect of imported inflation is more harmful on the poorest population.[2] Secondly, assuming that central bank credibility is a valuable tool to keep headline inflation under control and that the poorest households are more susceptible to the deleterious effect from the inflation tax, we assess whether the central bank credibility is more beneficial to the poor.

Our analysis uses data from the Brazilian economy because the country has several characteristics that allow us to extract important lessons for countries that face problems related to the effect of imported inflation and social inequality. Brazil is an emerging market with a significant share of international trade (Souza and Fry-McKibbin, 2021; Costa, Garred, and Pessoa, 2016). Therefore, international price variations have a high degree of contagion for domestic inflation. Another important aspect is that, if we consider the period 2007-2018, the median of inflation in Brazil is close to that observed in the group of emerging and developing countries (see figure 1). Furthermore, food inflation is higher than headline inflation for emerging countries and the Brazilian economy. In brief, Brazil is representative to investigate the effect of imported inflation on the headline and food inflation for open emerging and developing economies. Additionally, Brazil faces a problem of persistent social inequality (Signor, Kim, and Tebaldi, 2019). If we consider the period 2007-2018, the median Gini index for Brazil was 53.30, and in the case of emerging and developing economies, it was 40.12 (see figure 1). Finally, similarly to emerging and developing countries with inflation targets, central bank credibility is not consolidated (de Mendonça, 2018), which leads to the need for the central bank to have a greater commitment to inflation targets to maintain inflation under control. In summary, Brazil is a good laboratory experiment for this study because it is a large open emerging economy, inflation is not low, income inequality is high, and central bank credibility is not strong.

This paper uses monthly macroeconomic and social data from the Brazilian economy from June 2007 to December 2020. In particular, we use the inflation rates available from the Institute for Applied Economic Research (IPEA) because it permits us to consider the inflation of poor and rich. Furthermore, during the period under consideration significant shocks hit the Brazilian economy. From mid-2008, the

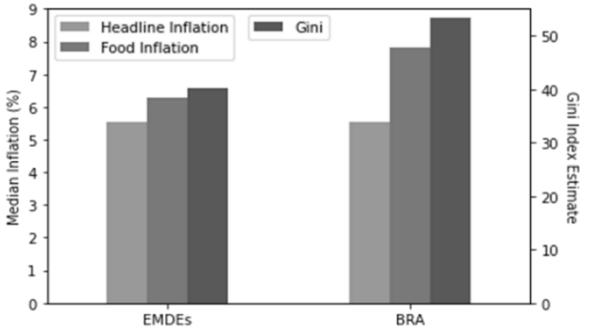
[1] Throughout this paper, we consider "imported inflation" as synonymous with the expressions "import price inflation" and "external inflation" usually found in the literature.

[2] On the impact of food inflation on low-income households, see Ginn and Pourroy (2020) and Fujii (2013).

international economy witnessed the great global financial crisis, and from the end of 2019, the beginning of the COVID-19 pandemic. It is natural that in periods of crisis, the most vulnerable households are the poorest due to limited access to financial instruments available to protect purchasing power (Erosa and Ventura, 2002). Therefore, the period under analysis allows one to assess the harmful impact of the imported inflation rate on the poor and rich and the effect that the central bank credibility has in mitigating inflationary pressures of any nature.

Figure 1

The headline and food inflation, and Gini index (*Brazil x EMDEs– average 2007-2018*)



Notes: Source of data Ha, Kose, and Ohnsorge (2019). *EMDEs* - emerging market and developing economies.

Although literature considers a "together effect" between the exchange rate pass-through to domestic inflation and central bank credibility through an interaction term (e.g., de Mendonça and Tostes, 2015), this is a result of a misunderstanding regarding inflation causes. While imported inflation affects the cost-push inflation, central bank credibility impacts the inflation of expectations. In other words, from the econometric view is unfair to consider an interaction when an independent variable does not have a different effect on the outcome due to the values of another independent variable. It is noteworthy that central banks are not able to affect changes in the relative prices of commodities and, therefore, it is not up to monetary policy to control changes in relative prices arising from supply shocks (Apaitan, Disyatat, and Manopimoke, 2020; Humpage, 2008; Humpage and Pelz, 2003). Furthermore, fluctuations in international prices are non-monetary factors and should be treated differently from aggregate demand shocks (Anand, Prasad, and Zhang, 2015; Wynne, 2008; Bernanke et al., 2001). Hence, based on a Phillips Curve framework, we analyze through Generalized Method of Moments regressions the independent effects of imported inflation and central bank credibility on inflation and its consequences for poor and rich. In addition, to analyze the duration of shocks transmitted by the imported inflation rate and central bank credibility on the differential rate between the poor and the rich, we consider impulse response functions from Autoregressive Vector models.

The baseline results indicate that a shock of 1 standard deviation in the average imported inflation causes an average increase in headline inflation of 2.66% and an average effect of 4.51% for food inflation. Furthermore, on average, a shock of 1 standard deviation in imported inflation increases the difference of inflation between poor and rich by around 0.91 percentage points. In other words, imported inflation amplifies the divergence between inflations that affect the income distribution between poor and rich. In contrast, a decrease in inflation due to central bank credibility is higher for the poor than for the rich. On average, a shock of 1 standard deviation in central bank credibility leads to a decrease in the differential rate of inflation between the poor and the rich of 0.56 percentage points. Hence, our findings support the view that central bank credibility is a helpful mechanism to contain the corrosive power of inflation in the most vulnerable social classes.

Our paper belongs to the branch of the literature concerning the impacts of inflation and monetary policy on income and wealth inequality (Coibion et al., 2017; Kaplan, Moll, and Violante, 2018; Romer and Romer, 1998). To the best of our knowledge, this is the first study to assess the heterogeneous effect of imported inflation on rich and poor in the case of a large emerging economy.[3] Although there is extensive analysis on inflationary pressure arising from imported prices, there is a gap in the literature regarding

[3] Hottman and Monarch (2020), using data regarding US households from 1998 to 2014, found evidence that imported inflation was higher for lowest-income households.

empirical evidence on the effect of the pass-through of imported inflation on the poorest in the case of emerging and developing economies.[4] Besides, although the literature is ambiguous regarding the effects of monetary policy on income inequality, there is a consensus that inflation above a certain threshold increases inequality (Colciago, Samarina, and de Haan, 2019). Moreover, there is evidence that the inflation targeting system maximizes social welfare (Anand, Prasad, and Zhang, 2015; Ginn and Pourroy, 2020). Hence, we introduce in the analysis central bank credibility of a country with inflation targeting to assess if it works as a remedy for the inflationary pressure on households of different income levels.

A credible monetary authority can guide agents' expectations to the inflation target, guaranteeing price stability without using the traditional monetary policy instrument (increases in the interest rate) that imply high social costs (de Mendonça, 2009). In particular, there is evidence that monetary authority transparency is an important tool to reduce inequality (de Mendonça and Esteves, 2018). However, studies that show the success of controlling inflation under inflation targeting consider an "average effect" on the society without distinguishing between poor and rich (e.g., de Mendonça and de Guimarães e Souza, 2012). Hence, since we analyze the effect of central bank credibility on different inflation of poor and rich, we introduce consumer heterogeneity into the analysis. As the consumption pattern varies according to household income level, it is palatable that an increase in inflation will have a different impact on the households' budget. In brief, our study brings light to analyze two essential issues: (i) check whether imported inflation affects differently poor and rich; and (ii) verify whether central bank credibility attenuates, mainly, the inflation of the poor.

The remainder of this paper is organized as follows. Section 2 introduces the measures of imported inflation, central bank credibility, headline and food inflation, and the relationship among them. Section 3 provides the empirical strategy. Section 4 shows empirical evidence for the headline and food inflation. Section 5 studies the relationship between inflation of poor and rich with imported inflation and central bank credibility. Section 6 analyzes the differential rate of inflation between the poor and the rich with imported inflation and central bank credibility. Lastly, section 7 concludes.

2. Relationship between headline and food inflation with imported inflation and central bank credibility measures

In order to analyze the evolution of the headline inflation and food inflation from June 2007 to December 2020 (monthly frequency), we consider the following indicators: *HINF* – headline inflation (accumulated in 12 months - %), as measured by the Extended National Consumer Price Index (IPCA - official price index in Brazil); and *FINF* – food inflation, which corresponds to food and beverages inflation rate accumulated in the last 12 months (%).[5] Figure 2 shows that most time the food inflation is higher than headline inflation. Over the period under consideration, average inflation food is 7.7%, while average headline inflation is 5.5%.

An essential independent variable in this research is the effect of imported inflation on the headline and food inflation. As a manner to increase reliability in our analysis, we take into account two proxies for imported inflation (accumulated in 12 months - %) that comprise changes in commodity prices and the exchange rate (CBB, 2020a):

(1) $INF1^{*} = \Delta PPI + EXCH$

(2) $INF2^{*} = \Delta COMBR$,

where: *PPI* is the Producer Price Index – all US commodities (available from the Federal Reserve Bank of St. Louis), and *EXCH* is the nominal exchange rate – period average in BRL/US$ (available from Time Series Management System Management System/CBB). $INF2^{*}$ is the Commodities Index – Brazil.

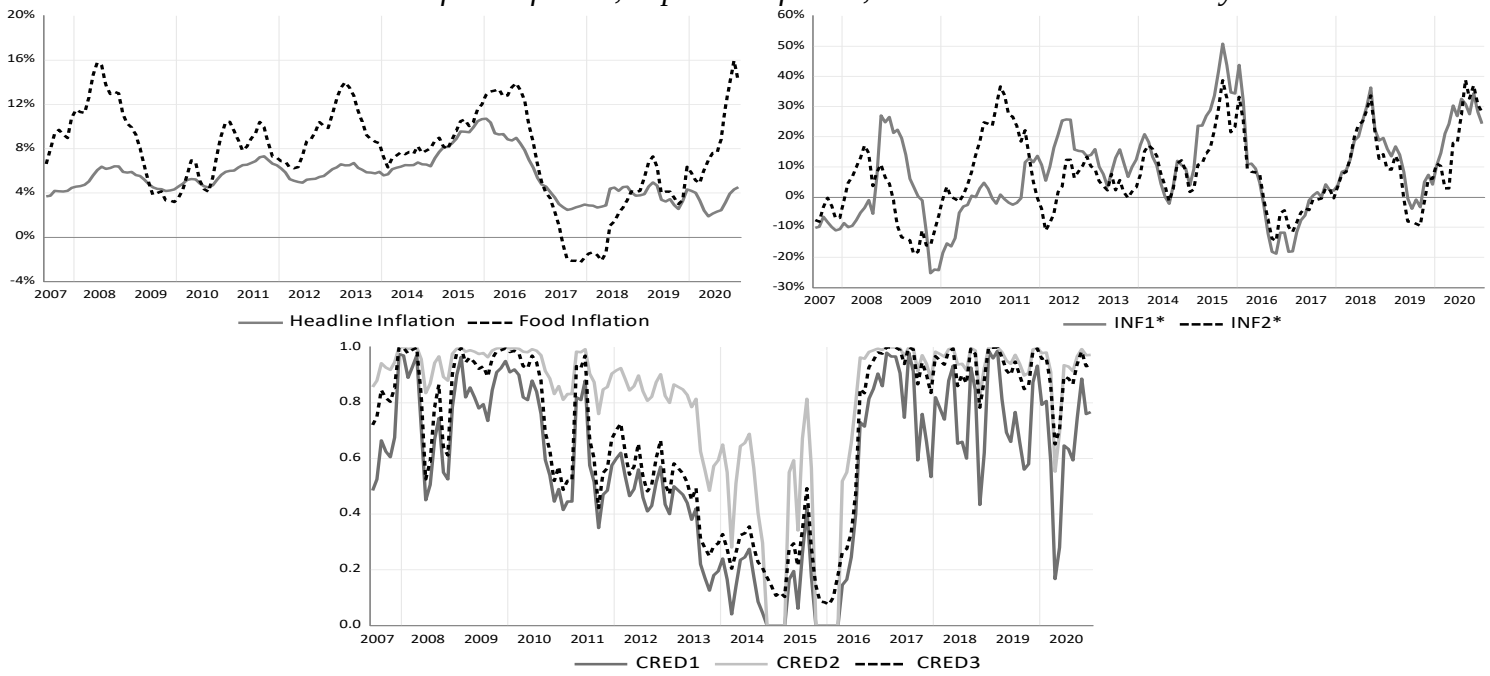
Figure 2 shows that although there exists a relationship between the two measures of imported inflation, most time, especially from 2007 to 2015, the difference between them is significant. The average imported inflation from the two indicators for the entire period under analysis corresponds to 8.2% for $INF1^{*}$ and 7.3% for $INF2^{*}$.

[4] For an analysis concerning imported inflation, see Albuquerque and Baumann (2017); Szafranek (2017); Watson (2014); and Gruen, Pagan, and Thompson (1999).

[5] Table A.1 (appendix) shows the descriptive statistics and sources for all variables in the models.

Figure 2

Headline and food inflation, imported inflation, and central bank credibility



Notes: Headline and food inflation rates (accumulated in 12 months). *INF*1* - Producer Price Index and exchange rate, and *INF*2* - Commodities Index – Brazil (accumulated in 12 months). *CRED*1, *CRED*2, and *CRED*3 - central bank credibility indexes (see equations 3 to 5).

Another independent variable of interest in this study is the central bank credibility. Based on the original Cukierman and Meltzer's (1986) credibility definition, we consider time-varying credibility indices appropriate for analyzing countries with an inflation targeting framework. The core of the idea is that, in countries with inflation targets, the stated target works as a "policymaker's plan" while inflation expectations represent "public beliefs" concerning that plan. In brief, we use indexes that capture the essence of credibility in an economy with an inflation target: the difference between inflation expectations and the inflation target. Precisely, we calculate three credibility indexes that go from 0 (without credibility) to 1 (maximum credibility), but they differ concerning the treatment of the deviation from inflation expectations to the target.

The first credibility index is based on de Mendonça (2007).[6] According to this perspective, credibility is maximum (*CRED*1=1) when inflation expectations are equal to the announced target, and it is equal to zero (*CRED*1=0) when inflation expectations exceed one of the bounds for the tolerance interval [INF^{lower}, INF^{upper}]. This indicator exhibits a linear loss of credibility as inflation expectations ($E(INF)$) depart from the inflation target (INF^{target}) until it reaches one of the bounds of the tolerance interval. In short, *CRED*1=[0,1]. Hence, considering a horizon of twelve months ahead (t+12):

(3) $CRED1_t =$

$$\begin{cases} 1 & \text{if} \quad E_t(INF_{t+12}) = INF_{t+12}^{target} \\ 1 - \frac{1}{INF_{t+12}^{upper} - INF_{t+12}^{target}} \left[E_t(INF_{t+12}) - INF_{t+12}^{target}\right] =]0,1[& \text{if} \quad INF_{t+12}^{target} < E_t(INF_{t+12}) < INF_{t+12}^{upper} \\ 1 - \frac{1}{INF_{t+12}^{lower} - INF_{t+12}^{target}} \left[E_t(INF_{t+12}) - INF_{t+12}^{target}\right] =]0,1[& \text{if} \quad INF_{t+12}^{lower} < E_t(INF_{t+12}) < INF_{t+12}^{target} \\ 0 & \text{if} \quad E_t(INF_{t+12}) \geq INF_{t+12}^{upper} \text{ or } E_t(INF_{t+12}) \leq INF_{t+12}^{lower} \end{cases}.$$

[6] Regarding the advantages of using this index compared to others, see de Mendonça (2018).

The second central bank credibility index (*CRED*2) considers a loss of credibility that is not linear when inflation expectations deviate from the announced target. Intuitively, it is reasonable to conjecture that the loss of credibility when there is a small divergence from inflation expectations to the target will be smaller than when the deviations are large. Hence, based on de Mendonça and Almeida (2019), the credibility index *CRED*2 is a result of:

(4) $CRED2_t =$

$$\begin{cases} 1 & \text{if} \quad E_t(INF_{i,t+12}) = INF_{i,t+12}^{target} \\ \frac{\sqrt{\left[INF_{i,t+12}^{target} - INF_{i,t+12}^{upper}\right]^2 - \left[E_t(INF_{i,t+12}) - INF_{t+12}^{target}\right]^2}}{INF_{i,t+12}^{upper} - INF_{t+12}^{target}} =]0,1[& \text{if} \quad INF_{i,t+12}^{target} < E_t(INF_{i,t+12}) < INF_{i,t+12}^{upper} \\ \frac{\sqrt{\left[INF_{i,t+12}^{target} - INF_{i,t+12}^{lower}\right]^2 - \left[E_t(INF_{i,t+12}) - INF_{t+12}^{target}\right]^2}}{INF_{i,t+12}^{target} - INF_{t+12}^{lower}} =]0,1[& \text{if} \quad INF_{i,t+12}^{lower} < E_t(INF_{i,t+12}) < INF_{i,t+12}^{target} \\ 0 & \text{if} \quad E_t(INF_{i,t+12}) \geq INF_{i,t+12}^{upper} \text{ or } E_t(INF_{i,t+12}) \leq INF_{i,t+12}^{lower} \end{cases}.$$

Lastly, we consider a credibility index (*CRED*3) that comprehends the asymmetric effect of positive and negative divergences between inflation expectations and the target. Based on Levieuge, Lucotte, and Ringuedé (2018), this index uses a linear exponential function (LINEX). The basic idea is that, in practice, inflation expectations below the target affect less the loss of credibility compared to the case of expectations exceeding the target. Hence:

(5) $CRED3_t =$

$$\begin{cases} 1 & \text{if} \quad E_t(INF_{t+12}) = INF_{t+12}^{target} \\ \frac{1}{\left\{\left[e^{\left[E_t(INF_{t+12}) - INF_{t+12}^{target}\right]}\right] - \left[E_t(INF_{t+12}) - INF_{t+12}^{target}\right]\right\}} = [0,1[& \text{if} \quad E_t(INF_{t+12}) \neq INF_{t+12}^{target} \end{cases}.$$

Figure 2 shows that although the credibility indexes follow the same trend over time, their difference is not negligible. A good example of disagreement among them is the average credibility regarding each one. *CRED*1, the index with a "linear punishment" for deviations between inflation expectations and the target, indicates the lowest average credibility (0.57), while *CRED*2, the index with a non-linear framework, has the highest (0.81). *CRED*3, the index with asymmetric effect, has an intermediate position with an average of 0.70.

To investigate, in a preliminary way, the relationship between the variables of interest, figure 3 provides several scatterplots. In general, we can see a positive correlation between imported inflation and headline inflation and between imported inflation and food inflation. In contrast, there is a negative correlation between central bank credibility and headline inflation and between central bank credibility and food inflation. In brief, while imported inflation may increase headline and food inflation, central bank credibility operates to reduce headline and food inflation.

3. Empirical strategy

Since the adoption of inflation targeting, the Central Bank of Brazil considers in its structural model of monetary policy a Phillips curve which has as essential components to explain the inflation (*INF*): lagged inflation rate (INF_{t-1}), inflation expectations (INF^e), output gap (*GAP*), and imported inflation (INF^*).[7] In other words, a hybrid Phillips curve close to:

(6) $INF_t = \alpha_1 INF_{t-1} + \alpha_2 INF_{t|t+h}^e + \alpha_3 GAP_t + \alpha_4 INF_t^* + \varepsilon_t,$

where $INF_{t|t+h}^e$ corresponds to inflation expectations formed at time t for time $t+h$; ε is an error term.

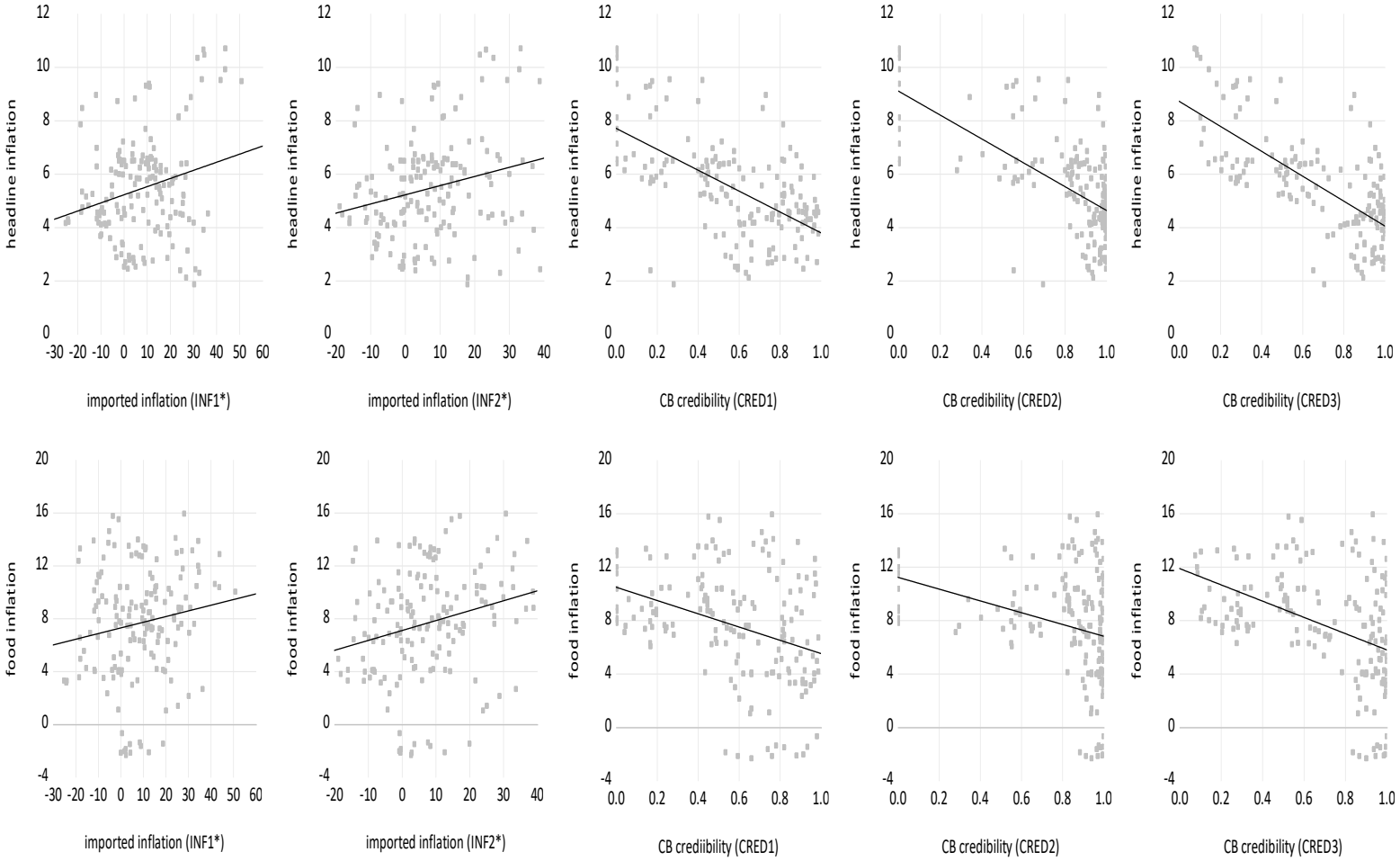
Under the inflation targeting environment, the target is one essential driver to guide expectations. Therefore, it is mandatory to consider how the inflation target ($\overline{INF}$) affects inflation in this framework. Specifically, it is reasonable to assume there is inflationary pressure when inflation expectations are greater than the target ($INF_{t|t+h}^e > \overline{INF}$). Hence, we can rewrite equation (6) as follows:

[7] Regarding the adoption of inflation targeting in Brazil and the original structural model of the transmission mechanism of monetary policy to prices, see Bogdanski, Tombini, and Werlang (2000).

(7) $INF_t = \alpha_1 INF_{t-1} + \alpha_2 (INF^e_{t|t+h} - \overline{INF}) + \alpha_3 GAP_t + \alpha_4 INF^*_t + \varepsilon_t$.

Figure 3

Relationship between headline and food inflation with imported inflation and central bank credibility



Notes: Headline and food inflation rates (accumulated in 12 months). *INF*1* - Producer Price Index and exchange rate, and *INF*2* - Commodities Index – Brazil (accumulated in 12 months). *CRED*1, *CRED*2, and *CRED*3 – central bank credibility indexes (see equations 3 to 5).

Equation (7) gives us a term that refers to a primary measure of central bank credibility (*CRED*), that is, the difference between inflation expectations and the target (Bordo and Siklos, 2014). Then:

(8) $INF_t = \alpha_1 INF_{t-1} + \alpha_2 CRED_t + \alpha_3 GAP_t + \alpha_4 INF^*_t + \varepsilon_t$.

Therefore, because the three credibility indexes previously shown has in its essence the gap between inflation expectations and the target, the following general model specification serves as a benchmark for the estimation of the effect of imported inflation and credibility:

(9) $INF_{i,t} = \delta_0 + \delta_1 INF_{i,t-1} + \delta_2 GAP_t + \delta_3 INF^*_{n,t} + \delta_4 CRED_{k,t} + \varepsilon_{i,t}$.

where $INF_i = \{HINF, FINF\}$. *GAP* is the output gap. In the same way as BoJ (2003), we use capacity utilization (manufacturing industry - seasonally adjusted – available from the Time Series Management System Management System/CBB) as a proxy for output gap on the sense of overcapacity in the industry. $INF^*_n = \{INF1^*, INF2^*\}$. $CRED_k = \{CRED1, CRED2, CRED3\}$.

In equation (9), the coefficient δ_3 measures the imported inflation's effect on the several types of inflation under analysis. Considering that an increase in imported inflation represents an increase in the production costs to the economy, we expect $\delta_3 > 0$. In contrast, considering that a credible central bank committed to its target helps control inflation, we expect a $\delta_4 < 0$.

Before performing the regressions, the first issue is to determine the series integration order. With this purpose, we carry on Augmented Dickey-Fuller (ADF) with a structural break, Dickey-Fuller Test with GLS Detrending (DF-GLS), and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test (see table A.2). The findings indicate that all series are I(0). Because we are using time series of macroeconomic data, a

parsimonious model for the analysis of imported inflation and central bank credibility, and inflation expectations used in the credibility indexes can be affected in some way by the current inflation; we use a model that provides robust results even with the presence of heteroscedasticity and endogeneity. In brief, we perform the regressions using the Generalized Method of Moments (GMM).[8] To validate the results, we execute a test for over-identifying moment conditions based on J-statistic and the Durbin-Wu-Hausman test to check the exogeneity of the equation regressors. Moreover, although there is no rule of thumb to the number of instruments, their proliferation can be a weakness in GMM models, and thus we limited the number of instruments for all models to less than 1/4 of the total observations.[9]

4. Empirical evidence of the relationship between headline and food inflation with imported inflation and central bank credibility

The regressions in table 1 show that the coefficients for imported inflation (INF_n^*) are positive while for central bank credibility ($CRED_k$) are negative and that both have statistical significance in all models. The result that an increase in imported inflation leads to an increase in the headline inflation and food inflation is consistent with the literature on the pass-through of imported inflation over domestic inflation (see, for example, Szafranek, 2017; Watson, 2014; Gruen, Pagan, Thompson, 1999; Turnovsky and Kaspura, 1974; Shinkai, 1973). The negative coefficient of central bank credibility confirms the hypothesis that a central bank committed to the inflation target is a useful tool for mitigating inflationary pressures of any nature (de Mendonça, 2018 and Tanuwidjaja and Choy, 2006).

Concerning the other explanatory variables in the models, the results are consistent with those usually found in the literature to analyze the Brazilian economy. Overall, the estimated coefficients for the lagged inflation rate (INF_{t-1}) are positive and significant (e.g., Boaretto and da Silva, 2019; de Mendonça and Tostes, 2015; and Minella, et al., 2003). In addition, the coefficients for the output gap (*GAP*) are consistent with the view that an increase in the output gap causes demand-pull inflation.

5. Relationship between inflation of poor and rich with imported inflation and central bank credibility measures

Because there is a positive effect of the imported inflation on food inflation, and poor households spend a larger part of their income on food, the inflation of poor and rich may be different. Furthermore, central banks use price indexes to capture changes in the prices of goods and services in a consumption basket representing the society. However, it is reasonable to conjecture that an increase in inflation has an uneven impact on the household's budgets with different income levels because they have different

The official price index to measure inflation in Brazil is the Extended National Consumer Price Index (IPCA), which considers price variations of a representative consumption basket for households with incomes from 1 to 40 minimum wages. To calculate the inflation for different levels of income, the Brazilian Institute for Applied Economic Research (Ipea) uses microdata from the Household Budget Survey (POF) to weigh the proportion of household income spent on goods and services. Hence, based on Ipea's classification by income level, we extracted the inflation of poor (*INFP*) through the average of very low income and low-income households, while inflation of rich (*INFR*) corresponds to the inflation of high-income households.

Based on rates of inflation faced by the poor and the rich, we compared their differences over time. Figure 4 shows the inflation gap between poor and rich households and the distribution regarding the inflation of the poor and rich. The difference between inflation of poor and rich is significant over the large part of the period under analysis. The graph regarding the distribution of inflation of poor and rich corroborates the view that the inflation is different for each group. In general, the inflation of the rich is more homogeneous and lower than the poor. Hence, due to the divergence between the inflation of the poor and the rich, it is possible to assume a heterogeneous effect of imported inflation and central bank credibility on the respective inflation rates.

[8] Regarding applications of GMM estimation, see Wooldridge (2001).
[9] The list of instruments for each model is available upon request to the authors.

Table 1

Effects of imported inflation and central bank credibility on headline inflation (HINF) and food inflation (FINF)

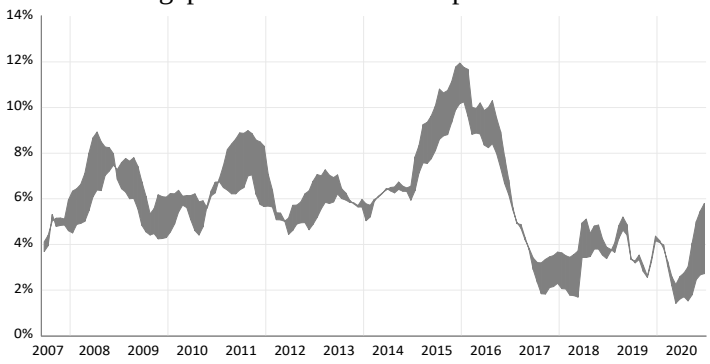
	INF_i^*		$CRED_k$			$INF1^* + CRED_k$			$INF2^* + CRED_k$		
Regressors:	**Model 1a**	**Model 2a**	**Model 3a**	**Model 4a**	**Model 5a**	**Model 6a**	**Model 7a**	**Model 8a**	**Model 9a**	**Model 10a**	**Model 11a**
$HINF_{t-1}$	0.957***	0.947***	0.947***	0.924***	0.927***	0.934***	0.914***	0.924***	0.938***	0.924***	0.930***
	(0.013)	(0.012)	(0.017)	(0.018)	(0.018)	(0.014)	(0.018)	(0.016)	(0.012)	(0.015)	(0.014)
GAP_t	0.050***	0.034***	0.029***	0.040***	0.023**	0.050***	0.056***	0.038***	0.035***	0.039***	0.027***
	(0.010)	(0.008)	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.011)	(0.009)	(0.007)	(0.008)
$INF1^*_t$	0.008***					0.008***	0.007***	0.006***			
	(0.002)					(0.002)	(0.003)	(0.002)			
$INF2^*_t$		0.015***							0.014***	0.014***	0.014***
		(0.002)							(0.002)	(0.002)	(0.002)
$CRED1_t$			-0.333**			-0.243*			-0.215*		
			(0.147)			(0.143)			(0.124)		
$CRED2_t$				-0.448***			-0.340*			-0.279*	
				(0.131)			(0.177)			(0.163)	
$CRED3_t$					-0.453***			-0.344**			-0.268**
					(0.156)			(0.145)			(0.133)
Adj. R^2	0.968	0.973	0.964	0.965	0.965	0.967	0.968	0.968	0.972	0.973	0.973
J-Statistic	17.601	14.192	16.307	15.363	17.423	17.134	14.895	16.459	16.552	14.823	11.669
Prob (J)	0.482	0.584	0.295	0.569	0.234	0.445	0.187	0.492	0.620	0.251	0.633
D-W-H Test	5.057	4.710	4.215	4.959	3.870	5.563	6.346	7.003	5.223	6.039	7.185
Prob(D-W-H)	0.168	0.194	0.239	0.175	0.276	0.234	0.175	0.136	0.265	0.196	0.126
Regressors	**Model 1a**	**Model 2a**	**Model 3a**	**Model 4a**	**Model 5a**	**Model 6a**	**Model 7a**	**Model 8a**	**Model 9a**	**Model 10a**	**Model 11a**
$FINF_{t-1}$	0.925***	0.934***	0.929***	0.932***	0.920***	0.917***	0.915***	0.912***	0.917***	0.919***	0.916***
	(0.020)	(0.018)	(0.023)	(0.021)	(0.027)	(0.018)	(0.019)	(0.019)	(0.017)	(0.017)	(0.017)
GAP_t	0.066	0.027	0.004	0.005	0.001	0.031	0.058	0.034	0.026	0.026	0.014
	(0.042)	(0.030)	(0.035)	(0.033)	(0.043)	(0.034)	(0.036)	(0.033)	(0.027)	(0.027)	(0.025)
$INF1^*_t$	0.020***					0.015***	0.019***	0.017***			
	(0.007)					(0.005)	(0.005)	(0.005)			
$INF2^*_t$		0.035***							0.033***	0.033***	0.033***
		(0.006)							(0.006)	(0.006)	(0.006)
$CRED1_t$			-0.706*			-0.483*			-0.393*		
			(0.366)			(0.277)			(0.212)		
$CRED2_t$				-0.680**			-0.381*			-0.368**	
				(0.268)			(0.218)			(0.164)	
$CRED3_t$					-0.826**			-0.469*			-0.367**
					(0.383)			(0.249)			(0.180)
Adj. R^2	0.947	0.955	0.944	0.943	0.943	0.946	0.946	0.949	0.956	0.955	0.955
J-Statistic	20.100	14.395	14.357	18.210	14.665	21.437	21.898	21.133	16.833	17.450	19.905
Prob (J)	0.168	0.421	0.423	0.508	0.145	0.613	0.585	0.685	0.664	0.683	0.702
D-W-H Test	2.190	5.945	5.139	3.030	3.666	1.528	1.686	2.842	6.807	6.609	4.393
Prob(D-W-H)	0.534	0.114	0.162	0.387	0.300	0.822	0.793	0.585	0.147	0.158	0.355

Notes: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denotes 0.10. Robust (Newey-West) standard errors are in parentheses. Prob(J) reports the respective p-valued of the J-test. D-W-H test is the Durbin-Wu-Hausman test (difference in J-stats), and the null hypothesis is that the regressors are exogenous. The constant term is included but not reported. *INF*1* - Producer Price Index and exchange rate, and *INF*2* - Commodities Index – Brazil. *CRED*1, *CRED*2, and *CRED*3 – central bank credibility indexes (see equations 3 to 5).

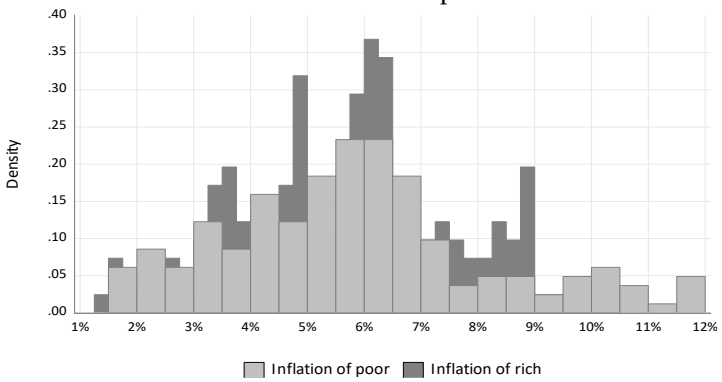
Figure 4

Inflation of poor and rich

The gap between inflation of poor and rich



Distribution of inflation of poor and rich

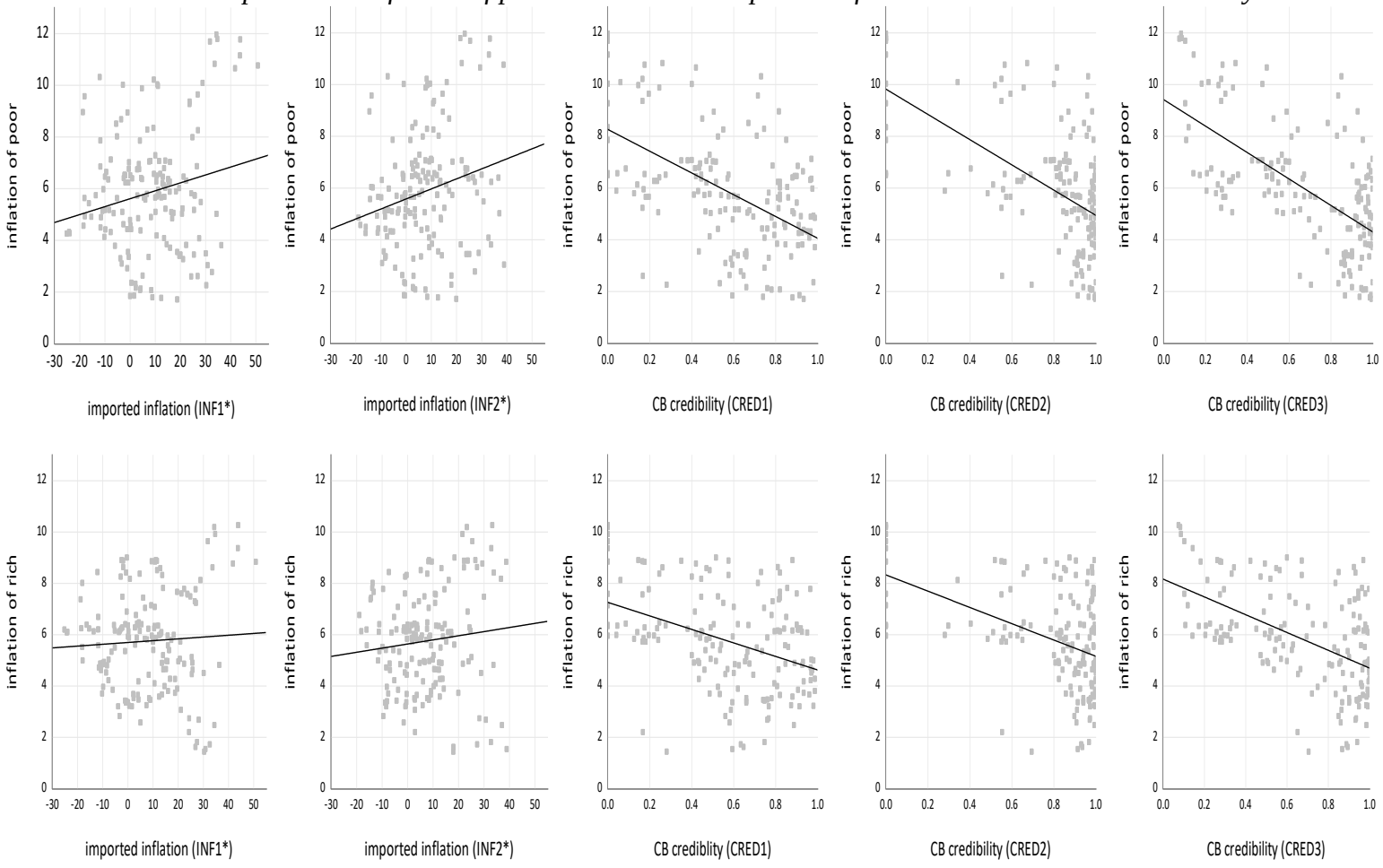


Note: Inflation of poor and rich accumulated in 12 months (%).

Figure 5 examines the relationship between imported inflation and the inflation of poor and rich and between central bank credibility and the inflation of poor and rich. As shown previously, there is a positive correlation between imported inflation and any type of inflation and a negative correlation between central bank credibility and inflation. However, the correlations for the group of inflation of poor are greater than inflation of rich. A possible interpretation is that imported inflation is a heavier burden for the poor and that central bank credibility can alleviate the harmful effects of inflation, especially for the poor.

Figure 5

Relationship between inflation of poor and rich with imported inflation and central bank credibility



Notes: Inflation of poor and rich accumulated in 12 months (%). *INF*1* - Producer Price Index and exchange rate, and *INF*2* - Commodities Index – Brazil (accumulated in 12 months). *CRED*1, *CRED*2, and *CRED*3 – central bank credibility indexes (see equations 3 to 5).

5.1. Empirical evidence of the relationship between inflation of poor and rich with imported inflation and central bank credibility

Using as reference the framework presented in section 3, we make new regressions for analyzing the effect of imported inflation and central bank credibility on inflation of poor (*INFP*) and rich (*INFR*) as follows:

(10) $INF_{m,t} = \omega_0 + \omega_1 INF_{i,t-1} + \omega_2 GAP_t + \omega_3 INF^*_{n,t} + \omega_4 CRED_{k,t} + \xi_{i,t}$.

where $INF_m = \{INFP, INFR\}$; $INF^*_n = \{INF1^*, INF2^*\}$; $CRED_k = \{CRED1, CRED2, CRED3\}$; and ξ is an error term.

The results in table 2 show that the coefficients associated with measures of imported inflation are positive and significant in all models. In particular, the magnitude of the coefficients is greater for the case of inflation of the poor. Regarding central bank credibility, the regressions reveal a negative and significant effect for both poor and rich. Nevertheless, the magnitude of the coefficients suggests that the effect of an increase in credibility in reducing inflation is stronger for the case of the poor.

To quantify how an increase in imported inflation and central bank credibility affects inflation of poor and rich, based on the models that use both INF_m^* and $CRED_k$ as regressors, we consider the effect of a shock of 1 standard deviation on the average imported inflation and average central bank credibility to the average inflation of the poor and rich. The results confirm that an increase in imported inflation is detrimental to the inflation of poor and rich, and the damaging effect is higher for the poor (table 3). A shock of 1 standard deviation on INF_m^* implies an average increase of around 2.97% in inflation of poor and 2.05% in the inflation of rich. Hence, our results agree with the result found by Hottman and Monarch (2020) that imported inflation provokes higher inflation for poor households in the USA. Contrary to the imported inflation effect, an increase of 1 standard deviation in the central bank credibility diminishes the average inflation of poor and rich by approximately 1.46% and 0.91%, respectively. In brief, the benefit of increasing central bank credibility in terms of reducing inflation is higher for the poor than the rich.

6. Relationship between the differential rate of inflation between the poor and the rich with imported inflation and central bank credibility measures

In order to verify whether the imported inflation amplifies the divergence of inflation for the poor and rich and whether central bank credibility can attenuate this deviation, we repeat previous analysis considering the difference between the inflation of the poor and rich (*DINF*).[10] The correlations between imported inflation and *DINF* suggest a "distorting effect" of imported inflation, that is, a higher effect on the inflation of the poor, which consequently leads to a widening of the difference between the inflation of poor and rich (see figure 6). Furthermore, there is a negative relationship between central bank credibility and the inflation gap between the poor and the rich in all cases.

Since there is a difference in the effect of imported inflation and central bank credibility on the inflation of poor and rich, we extend our analysis to see whether imported inflation leads to an increase and credibility to a reduction in the inequality of inflation between poor and rich. In brief, based on the framework in section 3, we perform new regressions taking into account the following specification:

(11) $DINF_t = \theta_0 + \theta_1 DINF_{t-1} + \theta_2 GAP_t + \theta_3 INF^*_{n,t} + \theta_4 CRED_{k,t} + \zeta_{i,t}$.

Where $INF^*_n = \{INF1^*, INF2^*\}$; $CRED_k = \{CRED1, CRED2, CRED3\}$; and ζ is an error term.

The results in table 4 indicate that, in all models, the coefficients of imported inflation are positive, and the coefficients of central bank credibility are negative and significant. In other words, an increase in imported inflation exacerbates the inflation gap between the poor and the rich, while an increase in central bank credibility contributes to more "homogeneous" inflation.

[10] *DINF* (the difference between poor and rich inflation) is the result of the difference between *INFP* and *INFR*.

Table 2

Effects of imported inflation and central bank credibility on inflation of poor (INFP) and inflation of rich (INFR)

	INF_m^*		$CRED_k$			$INF1^* + CRED_k$			$INF2^* + CRED_k$		
Regressors:	**Model 1a**	**Model 2a**	**Model 3a**	**Model 4a**	**Model 5a**	**Model 6a**	**Model 7a**	**Model 8a**	**Model 9a**	**Model 10a**	**Model 11a**
$INFP_{t-1}$	0.938***	0.953***	0.932***	0.915***	0.923***	0.925***	0.906***	0.913***	0.931***	0.924***	0.927***
	(0.017)	(0.015)	(0.023)	(0.022)	(0.021)	(0.012)	(0.024)	(0.017)	0.014	(0.015)	(0.017)
GAP_t	0.052***	0.034**	0.036**	0.035**	0.024	0.046***	0.056***	0.045***	0.038***	0.039***	0.034***
	(0.015)	(0.014)	(0.015)	(0.014)	(0.016)	(0.010)	(0.017)	(0.014)	0.012	(0.012)	(0.013)
$INF1*_t$	0.011***					0.009***	0.008**	0.010***			
	(0.003)					(0.003)	(0.003)	(0.003)			
$INF2*_t$		0.018***							0.016***	0.016***	0.016***
		(0.002)							(0.003)	(0.003)	(0.003)
$CRED1_t$			-0.340*			-0.282*			-0.315**		
			(0.204)			(0.159)			(0.161)		
$CRED2_t$				-0.542***			-0.392*			-0.384**	
				(0.175)			(0.235)			(0.163)	
$CRED3_t$					-0.511**			-0.336*			-0.324**
					(0.215)			(0.203)			(0.185)
Adj. R^2	0.962	0.967	0.960	0.961	0.961	0.963	0.962	0.964	0.967	0.968	0.968
J-Statistic	14.299	13.049	9.639	11.789	12.124	20.779	12.320	15.690	15.204	13.913	15.247
Prob (J)	0.353	0.444	0.473	0.545	0.436	0.705	0.420	0.546	0.648	0.735	0.645
D-W-H Test	3.686	3.706	5.719	4.042	4.365	1.499	4.890	3.635	2.076	3.798	2.619
Prob(D-W-H)	0.297	0.295	0.126	0.257	0.225	0.827	0.299	0.458	0.722	0.434	0.624
Regressors	**Model 1a**	**Model 2a**	**Model 3a**	**Model 4a**	**Model 5a**	**Model 6a**	**Model 7a**	**Model 8a**	**Model 9a**	**Model 10a**	**Model 11a**
$INFR_{t-1}$	0.955***	0.963***	0.948***	0.947***	0.953***	0.943***	0.941***	0.935***	0.954***	0.948***	0.941***
	(0.015)	(0.017)	(0.021)	(0.019)	(0.018)	(0.019)	(0.015)	(0.017)	(0.020)	(0.016)	(0.017)
GAP_t	0.060***	0.042***	0.037***	0.043***	0.046***	0.053***	0.061***	0.060***	0.041***	0.049***	0.042***
	(0.012)	(0.011)	(0.013)	(0.012)	(0.010)	(0.009)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)
$INF1*_t$	0.007***					0.005**	0.006***	0.005**			
	(0.002)					(0.003)	(0.002)	(0.002)			
$INF2*_t$		0.013***							0.010**	0.013***	0.013***
		(0.002)							(0.004)	(0.002)	(0.002)
$CRED1_t$			-0.244*			-0.217**			-0.181*		
			(0.129)			(0.121)			(0.100)		
$CRED2_t$				-0.259**			-0.219**			-0.215*	
				(0.131)			(0.123)			(0.127)	
$CRED3_t$					-0.205**			-0.199*			-0.193**
					(0.100)			(0.119)			(0.116)
Adj. R^2	0.963	0.968	0.961	0.962	0.962	0.962	0.963	0.963	0.967	0.968	0.967
J-Statistic	14.897	4.726	13.147	13.886	20.489	10.374	18.253	17.834	10.205	16.198	10.169
Prob (J)	0.314	0.909	0.156	0.382	0.428	0.734	0.633	0.598	0.747	0.704	0.858
D-W-H Test	0.889	1.851	0.376	1.815	0.574	0.371	0.646	1.385	1.260	0.528	3.655
Prob(D-W-H)	0.828	0.604	0.945	0.612	0.902	0.985	0.958	0.847	0.868	0.971	0.455

Notes: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denotes 0.10. Robust (Newey-West) standard errors are in parentheses. Prob(J) reports the respective p-valued of the J-test. D-W-H test is the Durbin-Wu-Hausman test (difference in J-stats), and the null hypothesis is that the regressors are exogenous. The constant term is included but not reported. *INF*1* - Producer Price Index and exchange rate, and *INF*2* - Commodities Index – Brazil. *CRED*1, *CRED*2, and *CRED*3 – central bank credibility indexes (see equations 3 to 5).

Table 3

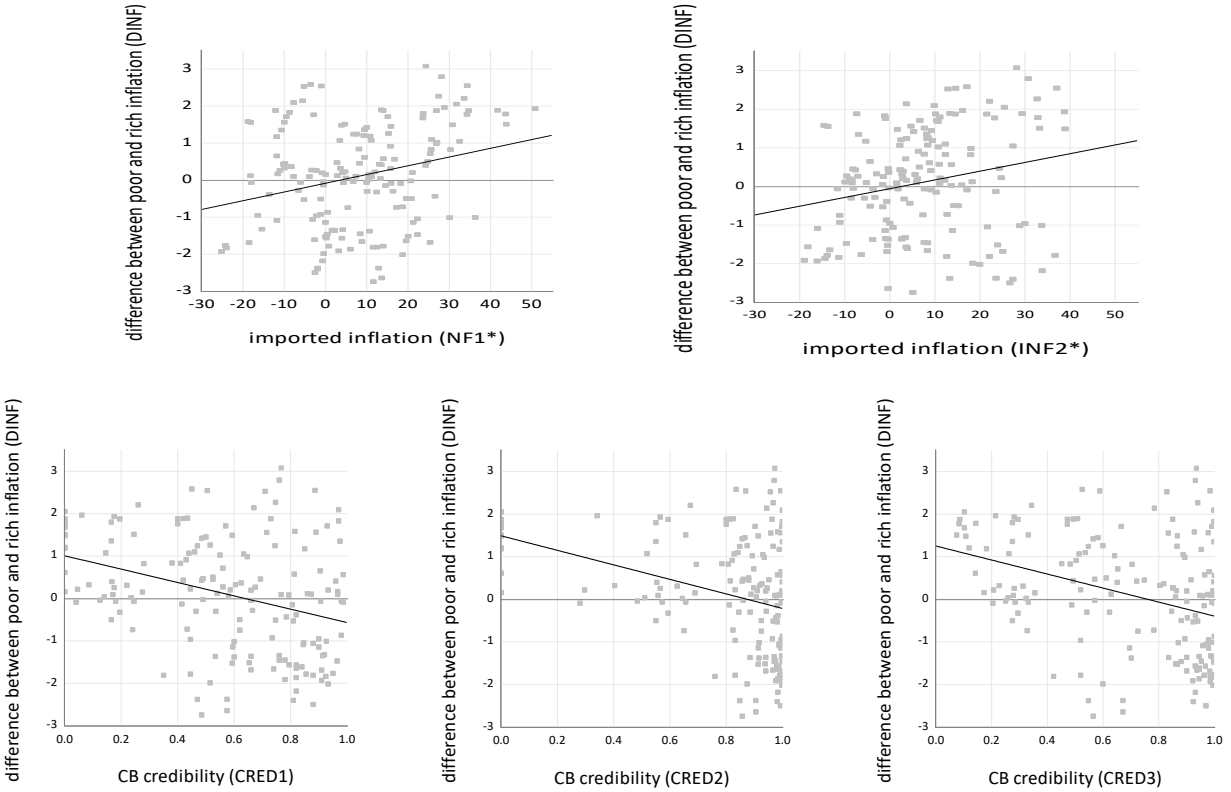
Effects of imported inflation and central bank credibility shocks (1 s.d.) on inflation of poor (INFP) and inflation of rich (INFR)

	shock	$INF1^* + CRED_k$			$INF2^* + CRED_k$			Average effect
		Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	
INFP:	INF_m^*	2.42%	2.11%	2.58%	3.52%	3.54%	3.62 %	2.97%
	$CRED_k$	-1.41%	-1.26%	-1.67%	-1.58%	-1.23%	-1.61 %	-1.46%
INFR:	INF_m^*	1.18%	1.54%	1.41%	2.21%	2.99%	3.00 %	2.05%
	$CRED_k$	-1.11%	-0.72%	-1.01%	-0.92%	-0.70%	-0.98 %	-0.91%

Notes: Impact of shocks of 1 standard deviation on inflation of poor and rich based on coefficients estimated in table 2. "Average effect" is the mean between the effects considering central bank credibility indexes (*CRED1*, *CRED2*, and *CRED3*) in the models.

Figure 6

Relationship between imported inflation and difference between inflation of poor and rich, and CB credibility and difference between inflation of poor and rich



Notes: *DINF* – the difference between poor and rich inflation (p.p.). *INF*1* - Producer Price Index and exchange rate, and *INF*2* - Commodities Index – Brazil (accumulated in 12 months). *CRED*1, *CRED*2, and *CRED*3 – central bank credibility indexes (see equations 3 to 5).

Table 5 reports the results of the impact of shocks of a 1 standard deviation to the averages of imported inflation and central bank credibility on the difference in inflation between the poor and the rich. On average, 1 standard deviation shock to imported inflation increases the inflation gap between the poor and rich by 64.02%, and a 1 standard deviation shock to credibility reduces this gap by 34.29%. This evidence is important because in economies where there are cash transfer programs (see, for example, Bolsa Família/Auxílio Brasil in Brazil, Oportunidades/Progresa in Mexico, Red de Protección Social in Nicaragua, Familias en Acción in Colombia), the central bank credibility can represent a tool for reducing social inequality. It is noteworthy when inflation rises, gains from cash transfer programs can be eroded with the fall in purchasing power.

Finally, because the duration of shocks matters for elaborating policies and taking decisions, based on the variables in equation (9), we perform an unrestricted vector autoregressive (VAR). An advantage of using VAR models is that they help characterize dynamic relationships (Baker, Bloom, and Davies, 2016).

Table 4

Effects of imported inflation and central bank credibility on the differential rate of inflation between the poor and the rich (DINF)

	INF_m^*		$CRED_k$			$INF1^* + CRED_k$			$INF2^* + CRED_k$		
Regressors:	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 11**
Constant	0.355	0.304	0.710	1.648*	1.020	0.857	0.503	0.784	0.847	0.832	1.130
	(0.900)	(0.896)	(1.071)	(0.927)	(1.117)	(0.811)	(0.848)	(0.928)	(0.837)	(0.849)	(0.898)
$DINF_{t-1}$	0.935***	0.956***	0.940***	0.951***	0.950***	0.934***	0.936***	0.928***	0.938***	0.946***	0.942***
	(0.023)	(0.022)	(0.024)	(0.026)	(0.025)	(0.020)	(0.022)	(0.024)	(0.022)	(0.018)	(0.019)
GAP_t	-0.005	-0.004	-0.008	-0.019	-0.011	-0.010	-0.006	-0.009	-0.010	-0.010	-0.013
	(0.011)	(0.011)	(0.013)	(0.012)	(0.014)	(0.010)	(0.010)	(0.011)	(0.010)	(0.011)	(0.011)
$INF1^*_t$	0.005***					0.004**	0.005***	0.005***			
	(0.002)					(0.002)	(0.002)	(0.002)			
$INF2^*_t$		0.005*							0.004*	0.005**	0.005**
		(0.003)							(0.002)	(0.002)	(0.002)
$CRED1_t$			-0.192*			-0.150*			-0.165*		
			(0.116)			(0.089)			(0.087)		
$CRED2_t$				-0.152*			-0.128*			-0.123*	
				(0.089)			(0.076)			(0.070)	
$CRED3_t$					-0.185*			-0.143*			-0.133*
					(0.109)			(0.085)			(0.077)
Adj. R^2	0.925	0.925	0.925	0.925	0.925	0.926	0.925	0.925	0.925	0.924	0.925
J-Statistic	14.054	11.005	17.115	18.602	16.978	23.071	21.739	18.935	19.036	21.837	22.147
Prob (J)	0.595	0.686	0.312	0.483	0.456	0.729	0.703	0.705	0.750	0.746	0.730
D-W-H Test	2.560	3.143	1.306	1.861	2.028	0.747	1.270	2.675	0.772	0.686	0.687
Prob(D-W-H)	0.465	0.370	0.728	0.602	0.567	0.945	0.866	0.614	0.942	0.953	0.953

Notes: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denotes 0.10. Robust (Newey-West) standard errors are in parentheses. Prob(J) reports the respective p-valued of the J-test. D-W-H test is the Durbin-Wu-Hausman test (difference in J-stats), and the null hypothesis is that the regressors are exogenous. *INF*1* - Producer Price Index and exchange rate, and *INF*2* - Commodities Index – Brazil. *CRED*1, *CRED*2, and *CRED*3 – central bank credibility indexes (see equations 3 to 5).

Table 5

Effects of imported inflation and CB credibility shocks (1 s.d.) on DINF

	shock	$INF1^* + CRED_k$			$INF2^* + CRED_k$			Average effect
		Model 6	*Model 7*	*Model 8*	*Model 9*	*Model 10*	*Model 11*	
DINF:	INF_m^*	59.43%	71.81%	71.53%	52.81%	65.78%	62.73%	64.02%
	$CRED_k$	-41.15%	-22.48%	-39.04%	-45.28%	-21.65%	-36.12%	-34.29%

Notes: Impact of shocks of 1 standard deviation on the differential rate of inflation between the poor and the rich (DINF) based on coefficients estimated in table 4. "Average effect" is the mean between the effects considering central bank credibility indexes (*CRED1*, *CRED2*, and *CRED3*) in the models.

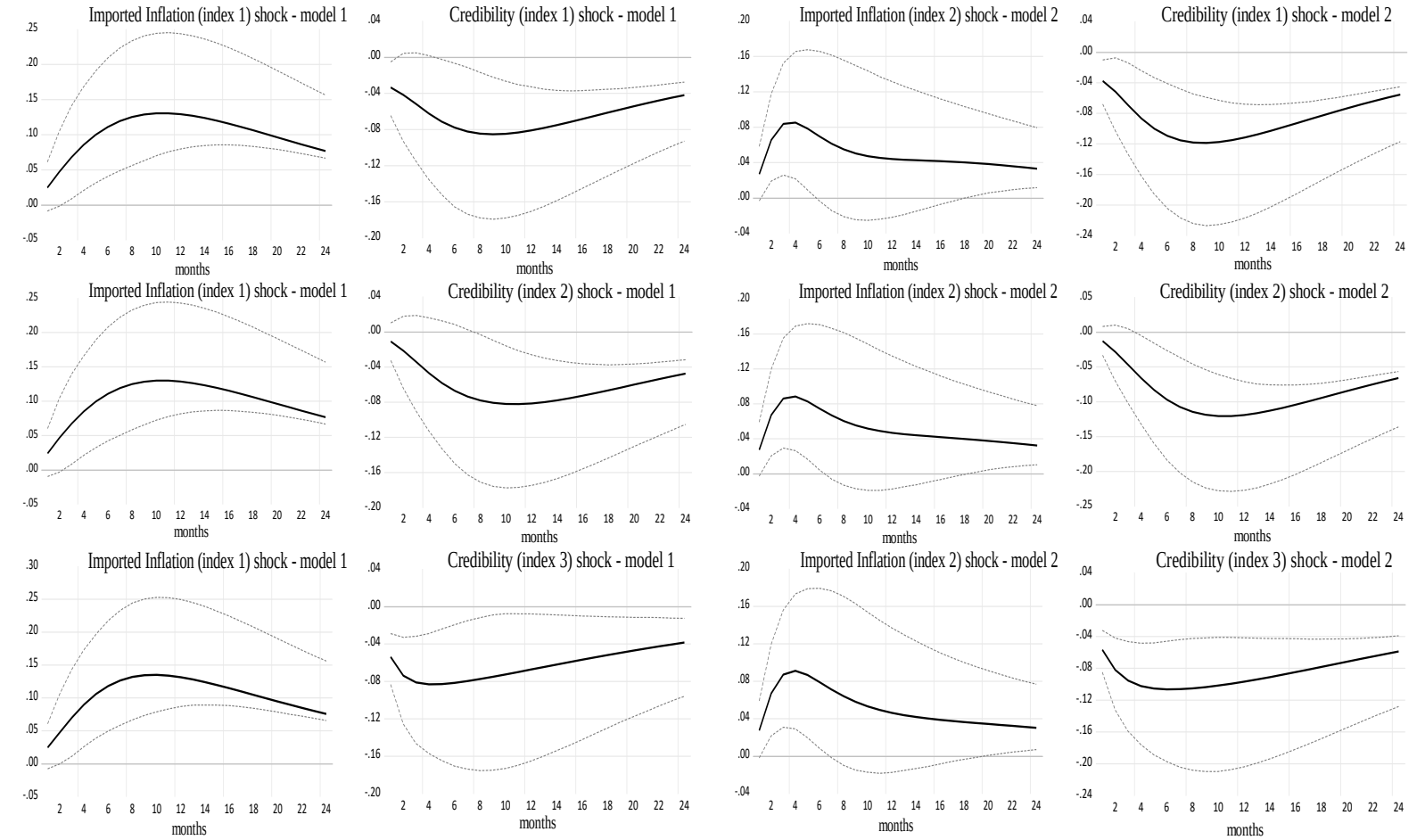
Furthermore, the use of VAR allows a flexible way to estimate the effects of economic shocks without considering the restrictions in structural models by treating every endogenous variable in the system. The VAR model in this study has the following general form:

$$(12) \quad DINF_{i,t} = \gamma_{0,i} + \sum_{j=1}^{p} \gamma_{1,i,j}\, DINF_{i,t-j} + \sum_{j=1}^{p} \gamma_{2,i,j}\, GAP_{t-j} + \sum_{j=1}^{p} \gamma_{3,i,j}\, INF^*_{n,t-j} + \sum_{j=1}^{p} \gamma_{4,i,j}\, CRED_{k,t-j} + \epsilon_{i,t},$$

where: γ_0 is a constant term; $j=1,2,\ldots,p$ (order); $INF_n^*=\{INF1^*, INF2^*\}$; $CRED_k=\{CRED1, CRED2, CRED3\}$; and ϵ is an innovation term (impulse or shock).[11] Precisely, to analyze the duration of the effect of shocks from imported inflation and central bank credibility on the inflation gap between poor and rich based on (12), we consider the *DINF* response to impulses transmitted by INF_n^* and $CRED_k$ (see figure 7).

Figure 7

Dynamics effects of imported inflation and CB credibility on the differential rate of inflation between the poor and the rich



Notes: Graphs show the differential rate of inflation between the poor and the rich responses to impulses of 1 standard deviation in INF_n^* and $CRED_k$. Confidence bands refer to a 1 standard interval (dashed lines) based on 20,000 Hall's percentile bootstrap replications (Hall, 1992). "Model 1" considers $INF1^*$ and $CRED_k$, while "model 2" considers $INF2^*$ and $CRED_k$. The three measures of credibility are not included simultaneously in the model but one at a time.

[11] Based on usual lags selection criteria, the models were estimated with two lags, and the condition of stability is satisfied (see table A.3 - appendix).

Figure 7 shows the results from two different sets of imported inflation and central bank credibility in the models. Specifically, the first and second columns show the differential rate of inflation between the poor and the rich responses to impulses from INF1* and CREDk, while the third and fourth columns show responses to impulses from INF2* and CREDk. Regardless of the model considered, a positive shock in the imported inflation rate leads to an immediate and significant increase in the difference of inflation between poor and rich. For models that take into account INF1*, the maximum effect of imported inflation happens around the ninth month, while for models with INF2*, the summit is around the fourth month.

7. Concluding remarks

Imported inflation plays a central role in determining domestic inflation in a globalized world. Using data from the Brazilian economy, we examine the impact of imported inflation on domestic inflation. In particular, we evaluated the effect of imported inflation on poor households and its consequences on the inflation gap between the poor and the rich. Furthermore, since central bank credibility is recognized as a mechanism for controlling the price level, we analyze whether an increase in credibility is more efficient in containing the inflation of the poor and contributes to reducing the inflationary inequality between the poor and the rich.

This study confirms the hypothesis that an increase in imported inflation over domestic inflation is positive and significant. Specifically, the results show that the effect of imported inflation on food inflation is greater than on headline inflation. Furthermore, the harmful effect of imported inflation is higher for poor households, leading to an increase in the differential rate between the poor and the rich. On the other hand, the results indicate that central bank credibility is an efficient mechanism to combat inflationary pressures on poor households. Precisely, a shock of 1 standard deviation to the average of imported inflation causes an average increase of 2.97% in inflation of the poor. In comparison, a shock of 1 standard deviation to the average of central bank credibility reduces inflation of the poor by approximately -1.46%.

Our analysis contributes to the literature that relies on the tripod: imported inflation – income inequality – central bank credibility. A significant novelty of the study is the evidence of a heterogeneous effect of imported inflation and central bank credibility on the poor and rich. Our results have significant consequences for monetary policy in emerging and developing countries that face social inequality. According to empirical evidence, an increase in central bank credibility represents a valuable tool in controlling inflation for households most vulnerable to the erosion of purchasing power. Considering that the rise in imported inflation and its respective pass-through on inflation implies a greater burden on poor households, our results allow us to conjecture that the development of central bank credibility is a good strategy to control inflation and avoid worsening social inequality.

8. References

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Apppendix

Table A.1

Sources of data, description of the variables, and descriptive statistics

Variable	Description	Source	Mean	Median	Std. dev.	Max.	Min.
HINF	Headline inflation (accumulated in 12 months - %), as measured by the Extended National Consumer Price Index.	TSMS/CBB – code 13522.	5.478	5.260	1.929	10.710	1.880
FINF	Food inflation - food and beverages inflation rate accumulated in the last 12 months (%).	Devised by authors based on data available from TSMS/CBB – code 1635.	7.656	7.880	4.172	15.953	-2.317
INFP	Average inflation of very low income and low-income households (accumulated in the last 12 months - %).	Devised by authors based on data available from IPEA.	5.860	5.736	2.342	11.968	1.716
INFR	Inflation of high-income households accumulated in the last 12 months (%).	Devised by authors based on data available from IPEA.	5.753	5.873	1.950	10.268	1.442
GAP	Output gap - capacity utilization (manufacturing industry - seasonally adjusted).	TSMS/CBB – code 28554.	80.244	80.800	2.832	84.400	69.700
*INF1**	Producer Price Index (all US commodities) and nominal exchange rate (period average in BRL/US$) - accumulated in the last 12 months (%).	Devised by authors based on data available from Federal Reserve Bank of St. Louis and TSMS/CBB.	8.182	8.276	15.105	50.804	-25.254
*INF2**	Commodities Index – Brazil. Variation accumulated in the last 12 months - %.	Devised by authors based on data available from TSMS/CBB – code 27574.	7.300	6.359	13.103	38.870	-18.942
CRED1	Linear central bank credibility	Devised by authors based on de Mendonça (2007) – equation (3).	0.571	0.600	0.293	0.987	0.000
CRED2	Non-linear central bank credibility	Devised by authors based on de Mendonça and Almeida (2019) – equation (4).	0.812	0.917	0.268	1.000	0.000
CRED3	Asymmetric central bank credibility	Devised by authors based on Levieuge, Lucotte e Ringuedé (2018) – equation (5).	0.695	0.835	0.291	1.000	0.074
DINF	Differential rate of inflation between the poor and the rich.	Devised by authors based on *INFP* and *INFR*.	0.107	0.152	1.365	3.078	-2.745

Notes: TSMS/CBB – Time Series Management System. Institute for Applied Economic Research

Table A.2

Unit root and stationary tests (ADF, DF-GLS, and *KPSS)*

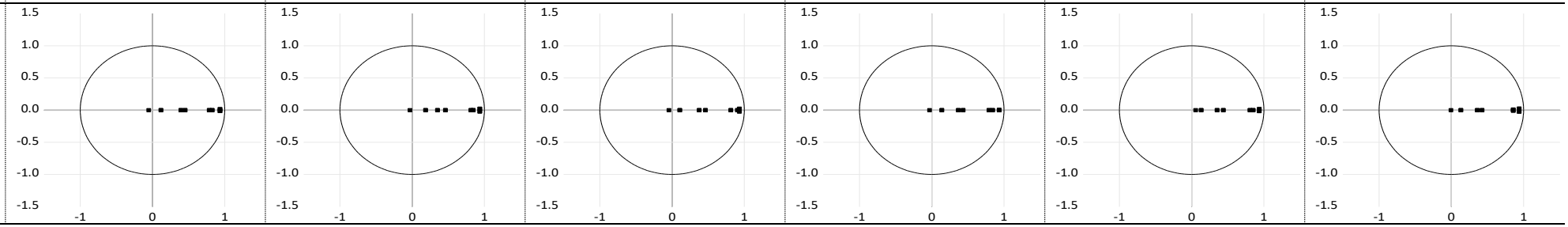
Variables:	I/T	Lags	Test	C.V. (10%)[a]	Lags	Test	C.V. (10%)[b]	Band	Test	C.V. (10%)[c]
HINF	I	1	-3.849	-2.644	1	-1.790	-1.615	80.3	0.212	0.347
FINF	I	1	-3.606	-2.644	1	-2.850	-1.615	78.4	0.323	0.347
INFP	I	1	-3.674	-2.644	1	-1.916	-1.615	74.9	0.252	0.347
INFR	I	1	-3.971	-2.644	1	-1.570	-1.615	87.7	0.309	0.347
GAP	I	0	-4.025	-3.470	0	-1.670	-1.615	44.1	0.427	0.347
*INF1**	I	1	-3.473	-3.082	1	-2.125	-1.615	37.9	0.371	0.347
*INF2**	I	1	-3.717	-3.082	1	-2.428	-1.615	33.7	0.314	0.347
CRED1	I	0	-3.247	-2.644	2	-2.210	-1.615	27.2	0.137	0.347
CRED2	I	0	-2.882	-2.644	0	-2.646	-1.615	31.3	0.131	0.347
CRED3	I	0	-2.476	-2.644	0	-2.083	-1.615	42.9	0.124	0.347
DINF	I	1	-2.260	-2.644	1	-2.292	-1.615	68.4	0.218	0.347

Notes: C.V. = critical value. Introduction of intercept and trend (I/T) based on graphical inspection. (a) Perron (1989) asymptotic one-sided p-values. (b) MacKinnon (1996). (c) Kwiatkowski-Phillips-Schmidt-Shin (1992). KPSS tests – spectral estimation method is Bartlett kernel, and the Andrews Bandwidth is used. The number of lags is based on the Schwarz criterion for ADF (breakpoint unit root test) and DF-GLS tests. Regarding ADF break dates: *HINF*, *FINF*, *INFP*, *INFR*, *CRED1*, *CRED2*, *CRED3*, and *DINF* - August 2016 - Senate removed President Rousseff from office; *GAP*- June 2015 – Brazil's recession. *INF1** and *INF2** - January 2016 - sharp fall in oil prices.

Table A.3

VAR lag order selection criteria and inverse roots of AR characteristic polynomial

VAR	**Model 1: *INF1*+CRED1***			**Model 1: *INF1*+CRED2***			**Model 1: *INF1*+CRED3***			**Model 2: *INF1*+CRED1***			**Model 2: *INF1*+CRED2***			**Model 2: *INF1*+CRED3***		
Order	AIC	SC	HQ	AIC	SC	HQ	AIC	SC	HQ	AIC	SC	HQ	AIC	SC	HQ	AIC	SC	HQ
0	16.606	16.683	16.637	16.519	16.597	16.551	16.551	16.628	16.582	16.587	16.665	16.619	16.433	16.511	16.465	16.527	16.604	16.558
1	8.623	9.010*	8.780	8.269	8.656*	8.426	7.984	8.372*	8.142	8.574	8.962*	8.731	8.214	8.602*	8.372	7.932	8.320*	8.089
2	8.476*	9.174	8.759*	8.099*	8.797	8.383*	7.847*	8.545	8.130*	8.403*	9.101	8.687*	8.022*	8.720	8.306*	7.766*	8.464	8.050*
3	8.499	9.507	8.908	8.158	9.166	8.567	7.918	8.926	8.327	8.426	9.434	8.835	8.090	9.098	8.499	7.842	8.850	8.251
4	8.626	9.944	9.161	8.217	9.535	8.753	8.038	9.356	8.573	8.525	9.843	9.061	8.135	9.453	8.671	7.943	9.261	8.478
5	8.690	10.318	9.351	8.250	9.878	8.911	8.082	9.710	8.743	8.559	10.187	9.220	8.152	9.780	8.813	7.951	9.579	8.612



Notes: (*) denotes lag order selected by the criterion Akaike (AIC), Schwarz (SIC), and Hannan-Quinn (HQ). No root lies outside the unit circle. Var satisfies the stability condition.