Fiscal Influences on Inflation in FLAR+2 Countries, 2020-2023

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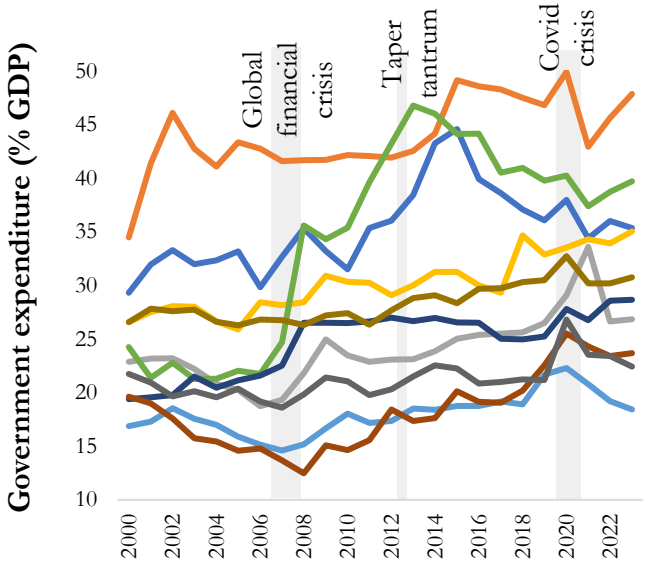
Introduction

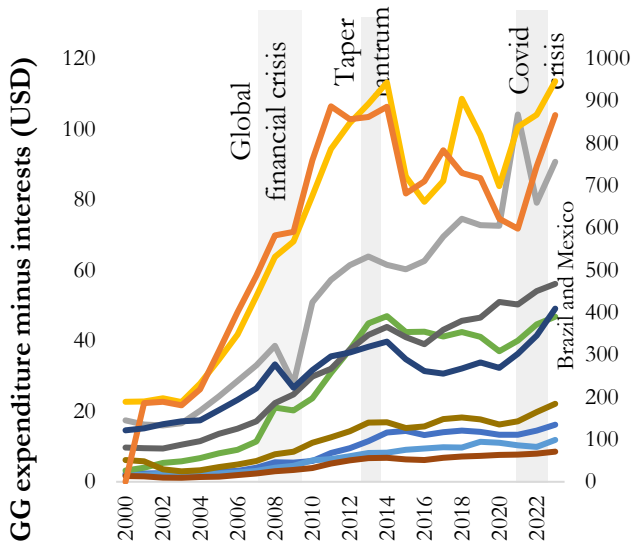
Inflation as a Fiscal Phenomenon

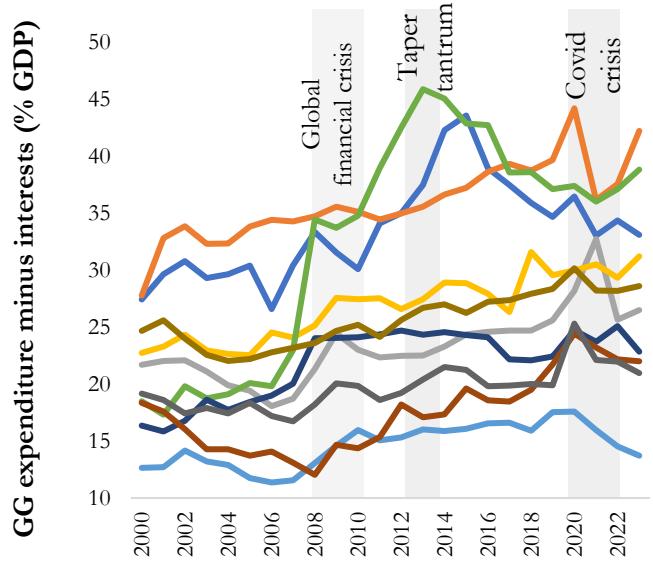
- ✓ Since at least Sargent and Wallace (1981), economists have been interested in the relation between inflation and fiscal policy
- ✓ A prolonged period of stable inflation in advanced economies has led to a decline in interest in the topic
- ✓ The large fiscal stimuli and subsequent spur in inflation during the pandemic have reignited the interest of several economists in the topic
- ✓ Barro and Bianchi (2024) document a strong link between the pandemic fiscal stimuli and inflation for OECD countries
- ✓ This paper extends the analysis to a large set of Latin American countries
- ✓ As in Barro and Bianchi (2024), we find **a strong link between fiscal policy and inflation**
- ✓ However, we also notice **some differences** with respect to Barro and Bianchi (2024)

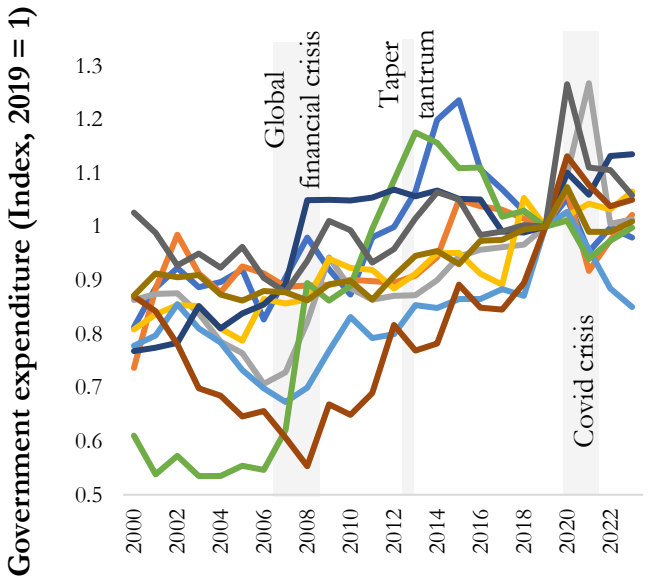
Stylized Facts
FLAR+2 countries

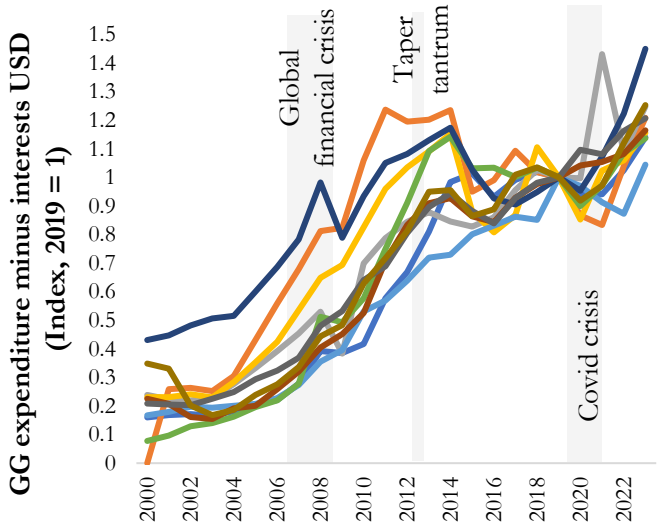
Government Expenditure and General government total expenditure minus interest

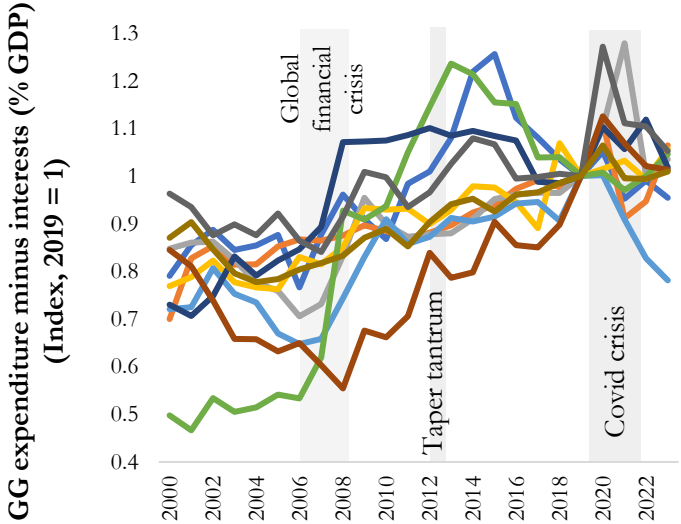








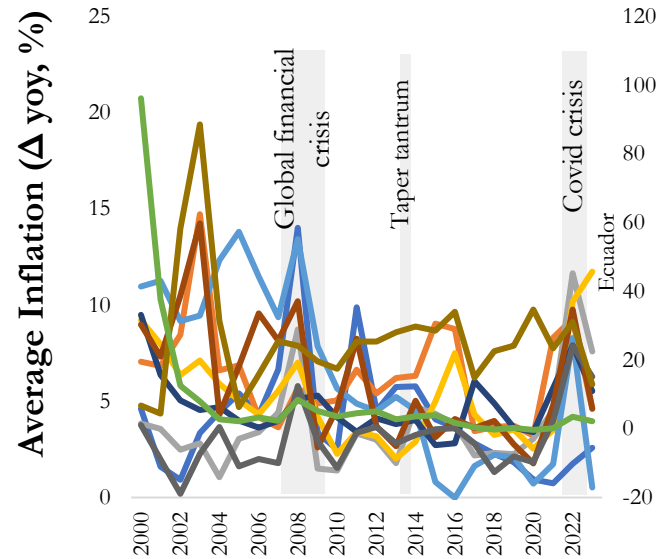


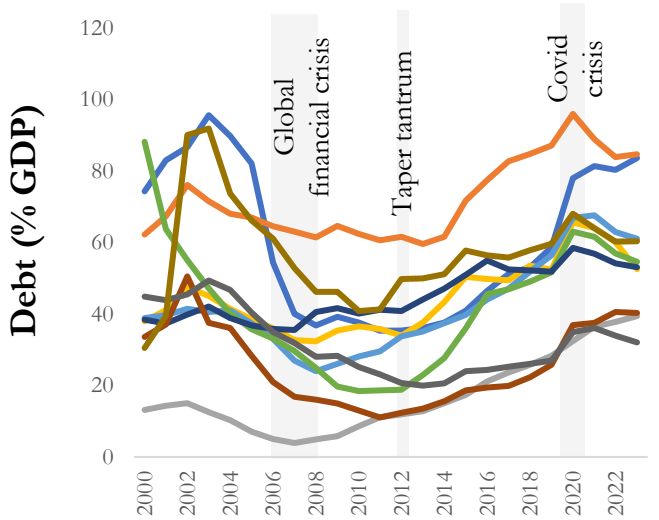


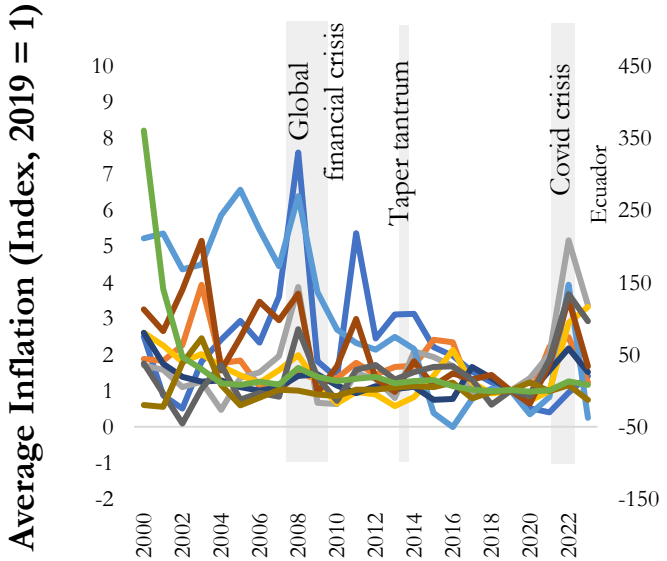
Data from: WEO IMF and Public Finances in Modern History IMF

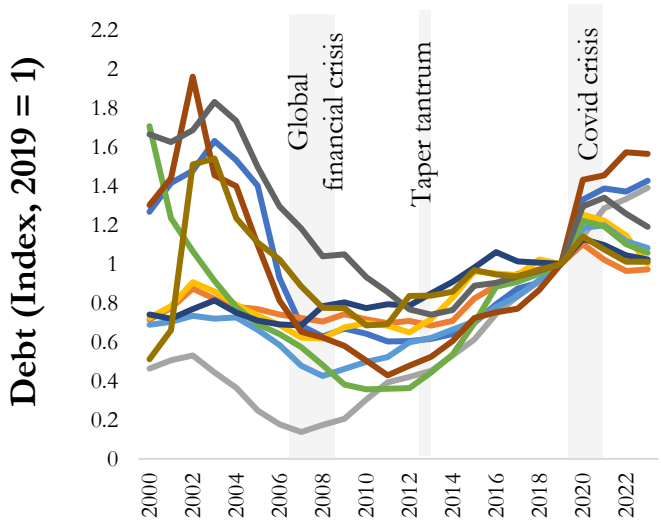
Bolivia Brazil Chile Colombia Costa Rica Mexico Paraguay Peru Uruguay Ecuador

Inflation and General Government Debt









Data from: WEO IMF

Bolivia Brazil Chile Colombia Costa Rica Mexico Paraguay Peru Uruguay Ecuador

Conceptual Framework

Conceptual framework

Inflation and Fiscal Stimuli

- ✓ Barro and Bianchi (2024) build on the fiscal theory of price level (FTPL)
- ✓ Market value of govt debt as present discounted value of future primary surpluses:

$$\frac{B_t}{P_t} = \sum_{i=1}^{\infty} \frac{(\mathcal{T}_{t+i} - G_{t+i})}{(1+r)^i}$$

- ✓ Left-hand side: Market value of debt depends on future inflation because of long term interest rates
- ✓ Assume a jump in spending that lasts M periods

$$Y_t \cdot \left[\Delta\left(\frac{G_t}{Y_t}\right) + \Delta\left(\frac{G_{t+1}}{Y_{t+1}}\right) + \cdots + \Delta\left(\frac{G_{t+M}}{Y_{t+M}}\right)\right]$$

- ✓ Assume maximum debt maturity T. Policymakers can stabilize debt by letting inflation increase over the pre-pandemic level for T periods
- ✓ Change in market value of debt generated by shift in inflation rates from $\pi*$ to sequence $\pi_{t+1} \ldots \pi_{t+T}$ given by)

$$\Delta B = \frac{B_t^*}{1+T}\left\{\left[\frac{(1+\pi^*)}{(1+\pi_{t+1})} - 1\right] + \left[\frac{(1+\pi^*)^2}{(1+\pi_{t+1})(1+\pi_{t+2})} - 1\right] + \cdots + \left[\frac{(1+\pi^*)^T}{(1+\pi_{t+1})\ldots(1+\pi_{t+T})} - 1\right]\right\}$$

- ✓ If higher inflation rate, π_{t+1}, is constant at $\pi > \pi*$ for T periods, result is:

$$\Delta B \approx -B_t^* \cdot \frac{1}{2} T \cdot (\pi - \pi^*)$$

Unfunded fiscal stimuli and inflation

Conceptual framework

- ✓ A parsimonious relation between change in inflation and COVID fiscal stimulus rescaled for amount and duration of outstanding debt

$$\pi - \pi^* = \eta \left(\sum_{i=1}^{M} \Delta \frac{G_{t+i}}{Y_{t+i}} \right) / \left(\frac{B_t^*}{P_t Y_t} \frac{T}{2} \right)$$

- ✓ The parameter η controls the share of unfunded spending that is stabilized via inflation
- ✓ A larger stock of outstanding debt lowers inflation: Implicit "inflation tax base" is larger
- ✓ A longer duration lowers inflation: Inflation can be smoothed over more years

Empirical investigation

- ✓ Verify that **composite spending variable** can account for cross-sectional variation in inflation
- ✓ **Panel regression for inflation** with country and time fixed effects plus various controls:

$$\pi_{it} = \pi_i^* + \eta \cdot (\Delta G)_{it} + X_t + \beta Z_{it} + u_{it}$$

- ✓ OLS regression for the post-pandemic **change in inflation**:

$$\Delta \pi_i = \eta \cdot (\Delta G)_i + \beta Z_i + u_{it}$$

Data Summary

Considerations

- ✓ The models were conducted for the following countries:
  - Bolivia
  - Brazil
  - Chile (OECD)
  - Colombia (OECD)
  - Costa Rica (OECD)
  - Ecuador
  - Mexico (OECD)
  - Paraguay
  - Peru
  - Uruguay

- ✓ The sample is considered from **2002 to 2023**, using yearly data.

Variable name	Description
Primary Expenditure	Natural logarithm of the Primary Expenditure in USD, computed by subtracting the interest payments from the total expenditure by country.
Real GDP	Natural logarithm of the Real Gross Domestic Product in USD.
Ukraine	Dummy = 1 for 2022 & 2023, = 0 otherwise.
Energy Index	Index considering the prices of Coal, Crude oil and Gas commodities.
Non-energy Index	Index considering the prices of Agricultural (Beverages, Food and Raw materials), Fertilizer, Metal & Mineral commodities

Dynamic Panel Model - Descriptive Statistics

Variable	Mean	SD	Max.	Min.
Headline CPI	0.051	0.032	0.194	-0.003
Primary Expenditure *in LN(USD)*	3.405	1.649	6.787	0.126
Real GDP *in LN(USD)*	4.663	1.513	7.525	1.139
Ukraine War	0.091	0.288	1	0
Energy index	88.698	25.208	129.905	44.889
Non-energy index	87.340	13.410	107.717	58.830

OLS Model- Descriptive Statistics

Variable	Mean	SD	Max.	Min.
Headline CPI	0.008	0.020	0.038	-0.028
$\Delta(G/Y)(2019-2020)$*	0.027	0.036	0.096	-0.015
$\Delta Y(2019-2020)$	-0.064	0.030	-0.008	-0.109
Covid (deaths per 1000)	3	1	7	2
Composite government spending variable	0.011	0.016	0.040	-0.006

*Δ(G/Y) is the cumulative increase in the ratio of general government primary spending to GDP for 2020 and 2021 expressed relative to the ratio for 2019.

Methodology

General equations: OLS and Dynamic Panel model

OLS

$$\Delta\text{Headline CPI} = \beta_0 + \beta_1 \text{ Composite Government Spending Variable} + \varepsilon_{i,t}$$

Dynamic Panel Model

$$\text{Headline } CPI_t = \beta_0 + \beta_1 \Delta\text{Headline}CPI_{t-1} + \beta_2 \Delta\text{Headline}CPI_{t-2} + \beta_3 \Delta\text{Primary Expenditure}_t + \beta_4 \Delta\text{Primary Expenditure}_{t-1} + \varepsilon_t$$

Dynamic Panel Model + controls

$$\text{Headline}CPI_t = \beta_0 + \beta_1 \Delta\text{Headline}CPI_{t-1} + \beta_2 \Delta\text{Headline}CPI_{t-2} + \beta_3 \Delta\text{Primary Expenditure}_t + \beta_4 \Delta\text{Primary Expenditure}_{t-1} + \beta_5 \Delta \textit{Real GDP}_t + \beta_6 \Delta \textit{Real GDP}_{t-1} + \beta_7 \Delta\text{Energy}_t + \beta_8 \Delta\text{Energy}_{t-1} + \beta_9 \Delta Non - \text{Energy}_t + \beta_{10} \Delta Non - \text{Energy}_{t-1} + \beta_{11} \Delta\text{Ukraine} + \varepsilon_t$$

Results

Identification equations and OLS model

Spending and real activity (EQ. 12): Latin American countries

$$\Delta(G/Y)(2020-2021) = \underset{(0.049)}{-0.082} - \underset{(0.428)}{0.604}\Delta Y(2019-2020) + \underset{(0.00009)}{0.00024}{}^{*}COVID$$

R-squared=0.39, σ=0.0277

Spending and real activity (EQ. 13): Latin American countries

$$\text{Composite Gov spending variable} = \underset{(0.019)}{-0.0416}{}^{(.)} - \underset{(0.164)}{0.2772}\Delta Y(2019-2020) + \underset{(0.00003)}{0.0001}{}^{*}COVID$$

R-squared=0.55, σ=0.0106

Evolution of inflation and composite spending (EQ. 14): Latin American countries (Panel model with country FE)

$$\pi\ (headline\ CPI)^{\dagger} = \underset{(0.002)}{0.0413}{}^{***} + \underset{(0.202)}{0.8149}{}^{***}composite\ G\ variable$$

R-squared=0.05, σ=0.0207

Jump in inflation and composite spending: Latin American countries (OLS Model)

$$\Delta\pi(\text{Headline CPI})^{\dagger\dagger} = 0.0008 + \underset{}{0.8142}{}^{*}\text{Composite G Variable}$$

Note: Signif. Codes 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

†: % Δ yoy on headline CPI ; † †: Δ between mean % Δ yoy on headline CPI 2020 - 2023 and 2010 - 2019

OLS

OLS model:

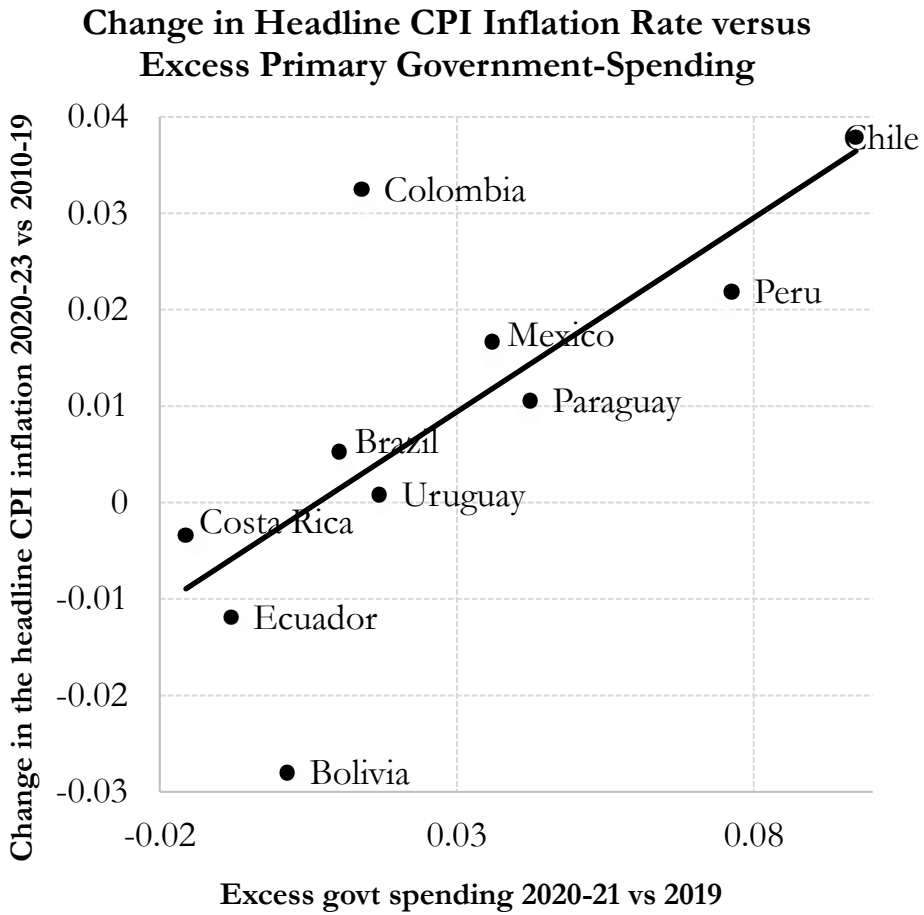
- ✓ Eq. 12 and 13 show no statistical significance in ΔY suggesting not systematic relation between spending and growth
- ✓ OLS regression shows statistical significance of government expenditure on headline and core inflation across all specifications.
- ✓ OLS regression shows statistical significance for the government spending variable in all specifications and all types of debt.
- ✓ Estimations using gross debt give coefficients close to the ones reported in Barro and Bianchi (2024) for OECD countries
- ✓ OLS regression using only the Excess of Government Spending shows significance for headline inflation.
- ✓ Taking the last two remarks into account, headline inflation appears to be positively influenced by variables associated with excess government spending and composite government spending.

OLS regression using the Excess of Government Spending

	Headline CPI Inflation Rate
Constant	-0.0026
Excess govt spending	0.4024*
Number of observations	10
R-squared	0.4705
s.e of regression	0.0146
log(likelihood)	29.16

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$$\pi - \pi^* = \eta \left(\sum_{i=1}^{M} \Delta \frac{G_{t+i}}{Y_{t+i}} \right)$$

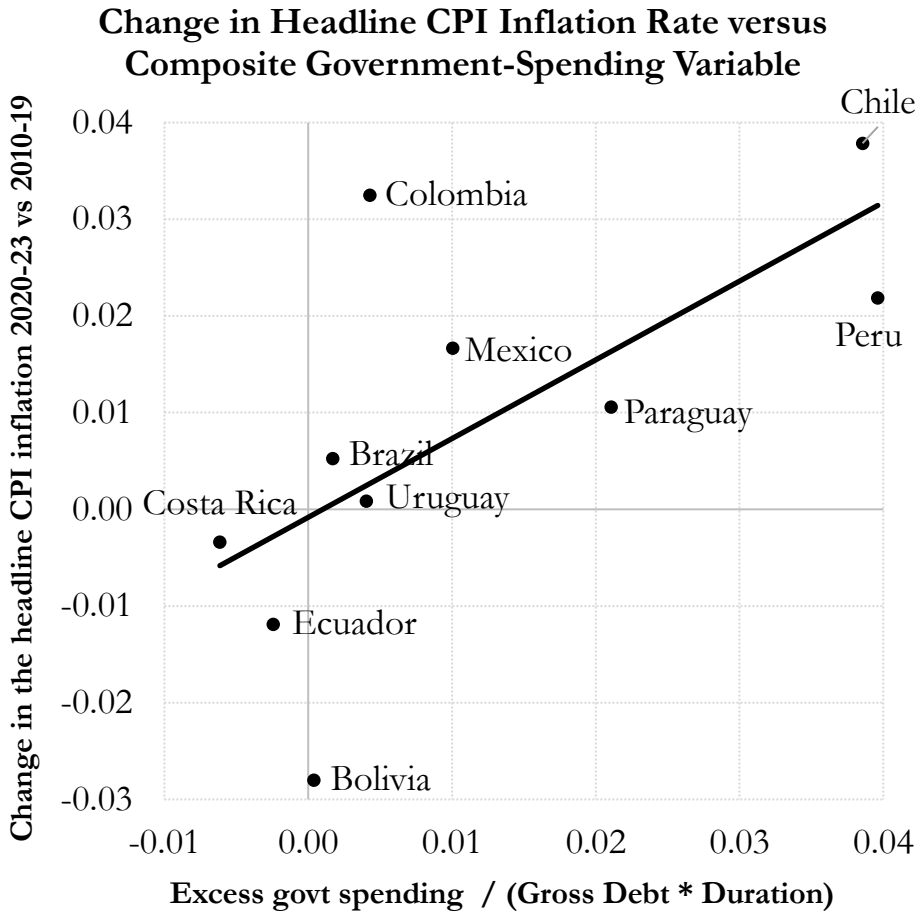


Final OLS regression using Composite Government Spending Variable

Weighted	Using Dt
	Headline CPI Inflation Rate
Constant	0.0008
Excess govt spending/(gross debt)* duration	0.8142*
Number of observations	10
R-squared	0.3752
s.e of regression	0.0159
log(likelihood)	28.33

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$$\pi - \pi^* = \eta \left(\sum_{i=1}^{M} \Delta \frac{G_{t+i}}{Y_{t+i}} \right) \Big/ \left(\frac{B_t^*}{P_t Y_t} \frac{T}{2} \right)$$



Note: In the empirical model, the expression T/2 corresponds to D_t, which is computed for this case as the weighted averages of the remaining duration of debt, measured as the difference between the bond's maturity date and the year under analysis, and weighted by the offering amount. It is equivalent to T, originally defined as the average remaining time to maturity reported by the OECD.

Final OLS regression using Composite Government Spending Variable – π 2016 – 2019

Weighted	Using Dt
	Headline CPI Inflation Rate
Constant	0.008
Excess govt spending/(gross debt)* duration	0.5919*
Number of observations	10
R-squared	0.4318
s.e of regression	0.0105
log(likelihood)	32.53

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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
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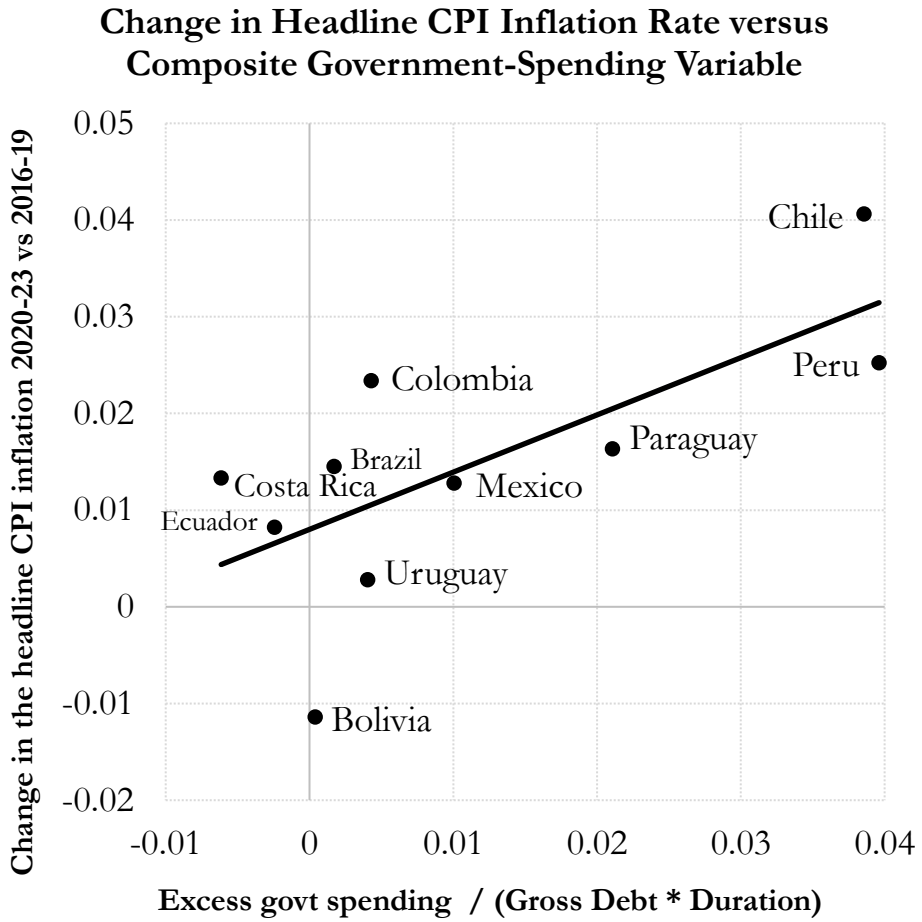
$$\pi - \pi^* = \eta \left(\sum_{i=1}^{M} \Delta \frac{G_{t+i}}{Y_{t+i}} \right) \Big/ \left(\frac{B_t^*}{P_t Y_t} \frac{T}{2} \right)$$



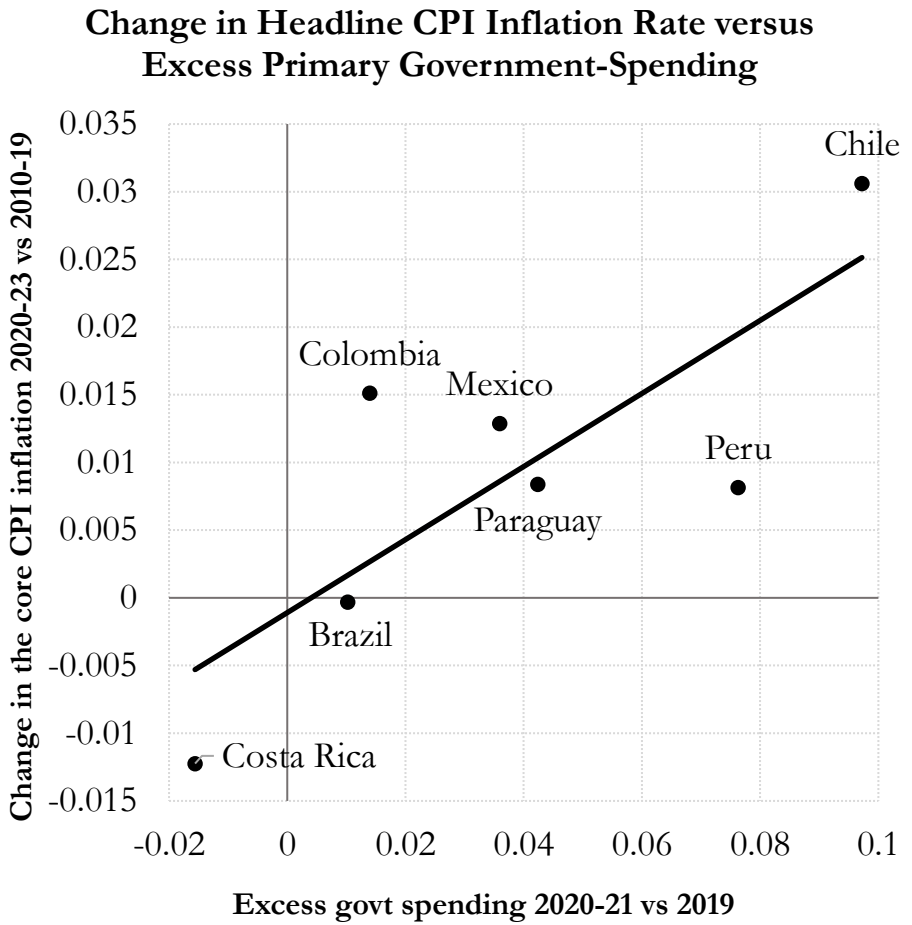
Note: In the empirical model, the expression T/2 corresponds to D_t, which is computed for this case as the weighted averages of the remaining duration of debt, measured as the difference between the bond's maturity date and the year under analysis, and weighted by the offering amount. It is equivalent to T, originally defined as the average remaining time to maturity reported by the OECD.

OLS regression using the Excess of Government Spending – Core Inflation

	Core CPI inflation rate
Constant	-0,0010
Excess govt spending	0.2698*
Number of observations	7
R-squared	0.5607
s.e of regression	0.0088
log(likelihood)	24,37

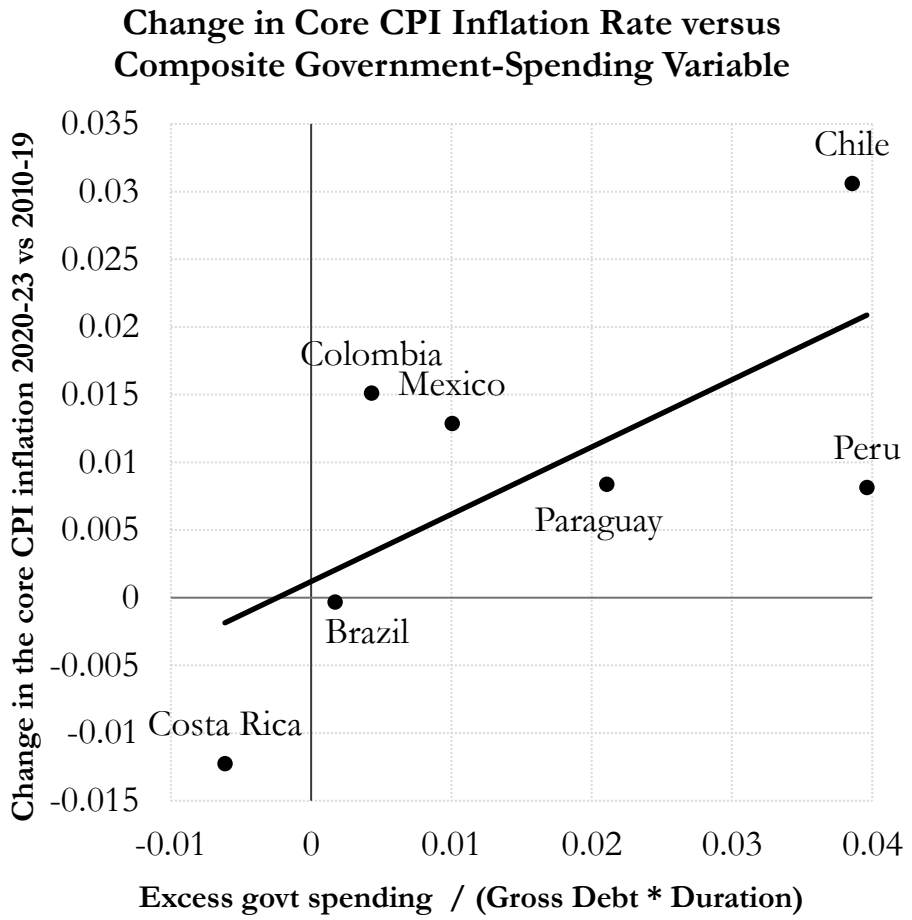
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$$\pi - \pi^* = \eta\left(\sum_{i=1}^{M} \Delta \frac{G_{t+i}}{Y_{t+i}}\right)$$



Final OLS regression using Composite Government Spending Variable – Full Sample – Core Inflation

Weighted	Using Dt
	Core CPI Inflation Rate
Constant	0.0012
Excess govt spending/(gross debt)* duration	0.4967(.)
Number of observations	7
R-squared	0.3480
s.e of regression	0.0107
log(likelihood)	22.99

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$$\pi - \pi^{*} = \eta \left(\sum_{i=1}^{M} \Delta \frac{G_{t+i}}{Y_{t+i}} \right) \Big/ \left(\frac{B_t^{*}}{P_t Y_t} \frac{T}{2} \right)$$

Note: In the empirical model, the expression T/2 corresponds to D_t, which is computed for this case as the weighted averages of the remaining duration of debt, measured as the difference between the bond's maturity date and the year under analysis, and weighted by the offering amount. It is equivalent to T, originally defined as the average remaining time to maturity reported by the OECD.

Dynamic Panel Model

- ✓ Fiscal expansions in Latin American countries have more determinants than just the COVID-19 crisis.
- ✓ The use of a dynamic panel enables the identification of the effects of additional variables that may be important for inflation.
- ✓ Other factors that should be considered are commodity prices, the political cycle, institutional quality, and capital flows. With this in mind, we collected several controls related to these factors and conducted numerous regressions.
- ✓ Incorporating commodity-related variables allows for capturing the relevance of these instruments for Latin America, as they may even influence inflationary dynamics according to the model.
- ✓ Finally, unlike the OLS model, the dynamic panel approach captures inflation persistence by including lagged values of the explanatory variables including the inflation.
- ✓ We find statistical significance of primary expenditure on headline inflation across all specifications and high persistence in inflation

Dynamic Panel Model equations

Dynamic Basic Model

$$Headline\ CPI_{\ t} = 0.0328^{***} + 0.353^{***}\Delta Headline\ CPI_{t-1} + 0.129^{*}\ \Delta Headline\ CPI_{t-2} + 0.0432^{**}\Delta \text{Primary Expenditure}_{t} + 0.00316\ \Delta \text{Primary Expenditure}_{t-1}$$

Dynamic Basic Model + controls

$$\text{Headline CPI}_{\ t} = 0.0201^{***} + 0.393^{***}\Delta \text{Headline CPI}_{t-1} - 0.0416\ \Delta \text{Headline CPI}_{t-2} + 0.0650^{***}\Delta \text{Primary Expenditure}_{t} + 0.0512^{***}\Delta \text{Primary Expenditure}_{t-1} - 0.135^{***}\ \Delta \text{Real GDP}_{t} - 0.0607^{**}\Delta \text{Real GDP}_{t-1} + 0.0003^{***}\Delta \text{Energy}_{t} - 0.0000\ \Delta \text{Energy}_{t-1} - 0.0004^{**}\ \Delta \text{NonEnergy}_{t} + 0.0004^{**}\ \Delta \text{NonEnergy}_{t-1} + 0.0194^{***}\Delta \text{Ukraine}$$

Note: Signif. Codes 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Dynamic Panel Model – Basic and Controls

Dynamic Panel –Basic Model

	(1)	(2)
VARIABLES	Headline Inflation	Headline Inflation
Headline Inflation (t-1)	0.353***	0.330***
	(0.0883)	(0.0855)
Headline Inflation (t-2)	-0.129*	-0.121*
	(0.0771)	(0.0711)
Δ Primary Expenditure (t)	0.0432**	0.0848***
	(0.0206)	(0.0303)
Δ Primary Expenditure (t-1)	0.00316	0.0222*
	(0.0117)	(0.0114)
Δ Real GDP (t)		-0.0690
		(0.0434)
Δ Real GDP (t-1)		-0.0294*
		(0.0154)
Constant	0.0328***	0.0303***
	(0.00706)	(0.00647)
Observations	200	200

Note: Δ = ln(variable in t) - ln(variable in t-1); Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Dynamic Panel Model – Basic and Controls

VARIABLES	(1) Headline Inflation	(2) Headline Inflation	(3) Headline Inflation	(4) Headline Inflation	(5) Headline Inflation
Headline Inflation (t-1)	0.353***	0.330***	0.400***	0.391***	0.393***
	(0.0883)	(0.0855)	(0.0933)	(0.103)	(0.0941)
Headline Inflation (t-2)	-0.129*	-0.121*	-0.0847	-0.0636	-0.0416
	(0.0771)	(0.0711)	(0.0591)	(0.0613)	(0.0494)
Δ Primary Expenditure (t)	0.0432**	0.0848***	0.0629***	0.0593***	0.0650***
	(0.0206)	(0.0303)	(0.0214)	(0.0223)	(0.0204)
Δ Primary Expenditure (t-1)	0.00316	0.0222*	0.0362***	0.0325***	0.0512***
	(0.0117)	(0.0114)	(0.00921)	(0.00907)	(0.00784)
Δ Real GDP (t)		-0.0690	-0.121***	-0.120***	-0.135***
		(0.0434)	(0.0392)	(0.0401)	(0.0405)
Δ Real GDP (t-1)		-0.0294*	-0.0659***	-0.0636***	-0.0607**
		(0.0154)	(0.0218)	(0.0229)	(0.0244)
Δ Energy (t)			0.000524***	0.000400***	0.000382***
			(0.000122)	(0.000106)	(0.000107)
Δ Energy (t-1)			0.000233***	0.000218**	-9.14e-07
			(8.84e-05)	(8.74e-05)	(0.000101)
Δ Non-energy (t)				0.000395*	0.000417**
				(0.000204)	(0.000210)
Δ Non-energy (t-1)				0.000320*	0.000410**
				(0.000173)	(0.000177)
Ukraine					0.0194***
					(0.00629)
Constant	0.0328***	0.0303***	0.0254***	0.0242***	0.0201***
	(0.00706)	(0.00647)	(0.00698)	(0.00681)	(0.00594)
Observations	200	200	200	200	200

Note: Δ = ln(variable in t) - ln(variable in t-1);
Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Conclusions

Inflation as a Fiscal Phenomenon

- ✓ We adopted the framework of Barro and Bianchi (2024) to study the link between inflation and fiscal stimuli in Latin America
- ✓ As for the OECD countries, fiscal stimulus rescaled by amount and duration of outstanding debt accounts for variation in inflation
- ✓ However, we also notice two interesting differences:
  - ✓ Link between headline inflation and fiscal stimuli strong even when not controlling for duration and amount of debt
  - ✓ Link between inflation and spending strong even outside COVID period
- ✓ In future work, we will investigate if differences are due to **weaker reputation for fiscal discipline**:
  - ✓ Before COVID, spending inflationary because agents fear debt monetization
  - ✓ During COVID, shorter spell of inflation to try to immediately restore credibility

Thanks!