# Cyclicality of tax expenditures

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**ABSTRACT**

*This paper examines the cyclicality of tax expenditures, using panel data for both developed and developing economies. The analysis reveals that tax expenditures exhibit pronounced procyclicality in developing economies, whereas in developed economies they display a countercyclical pattern. These results are consistent with prior research on statutory tax and deficit adjustments across the business cycle. By using a stylized model, I show that observed behavior in developing economies is consistent with debt constraints; in particular, legitimate lagged report of tax expenditures in the formal budget, creates an incentive for non-transparent political maneuvering.*

Key Words: Tax expenditures, Cyclicality, Developing Countries, Developed Countries

JEL Numbers– H24, H25 and H62.

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## 1. Introduction

Tax expenditure refers to preferential tax treatment — such as exemptions, deductions, credits, deferrals, and reduced rates — that governments implement worldwide to pursue various policy objectives. These benefits are typically granted under specific circumstances, often aimed at correcting market failures (e.g., short-sightedness in long-term saving) or addressing social welfare and income distribution concerns. For instance, exemptions in indirect taxation are commonly used to lower the prices of essential goods such as basic food items or fresh produce. In other cases, tax expenditures are linked to labor arrangements, such as training funds. More broadly, they serve as a flexible policy tool for supporting peripheral populations, encouraging the growth of new industries, or advancing political priorities. A widely used example is the income tax exemption for pension savings, designed to mitigate myopia among young workers.

These features make tax expenditures a central instrument of government policy. Indeed, evidence shows that in both developed and developing economies they have become quantitatively significant (see Figure 1). Yet, unlike statutory tax changes or direct spending, tax expenditures are rarely subject to systematic reporting in the budget process. This opacity underscores the need for economic research to evaluate their benefits and costs.

The absence of timely reporting and formal commitments to publish tax expenditure data has limited empirical research at the international level. Furthermore, governments' reluctance to ensure transparency creates incentives to deploy these instruments for political economy purposes. Ministers, influenced by the "common pool" problem[2], may prefer to use tax expenditures as a discreet means of honoring political commitments.

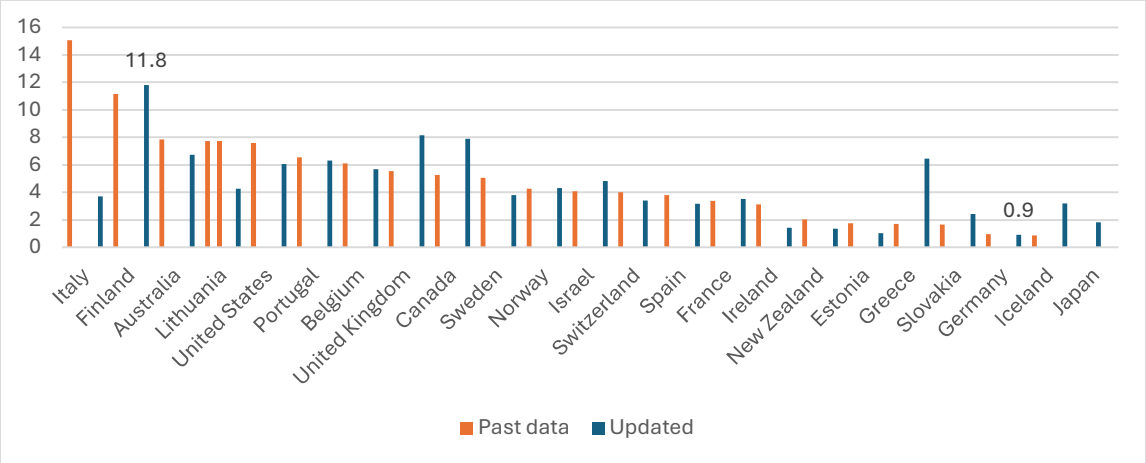
This lack of transparency is also intertwined with the business cycle. Governments are more likely to introduce tax expenditures during periods of economic expansion, when rising revenues help mask the associated revenue losses. In Section 4 I present a model illustrating the expected behavior of policy-makers in both developed and developing economies.

Figure 1a illustrates actual total tax expenditures as a percentage of GDP in the developed countries that are included in the current sample, ordered from high to low

[2] See Von Hagen and Harden (1994).

according to past data.[3] While the use of tax expenditures varies across nations, the quantitative importance is characterized by a wide range. On the one hand, Australia provides 11.8 percent of GDP as tax expenditures, while on the other extreme Germany provides 0.9 percent of GDP.

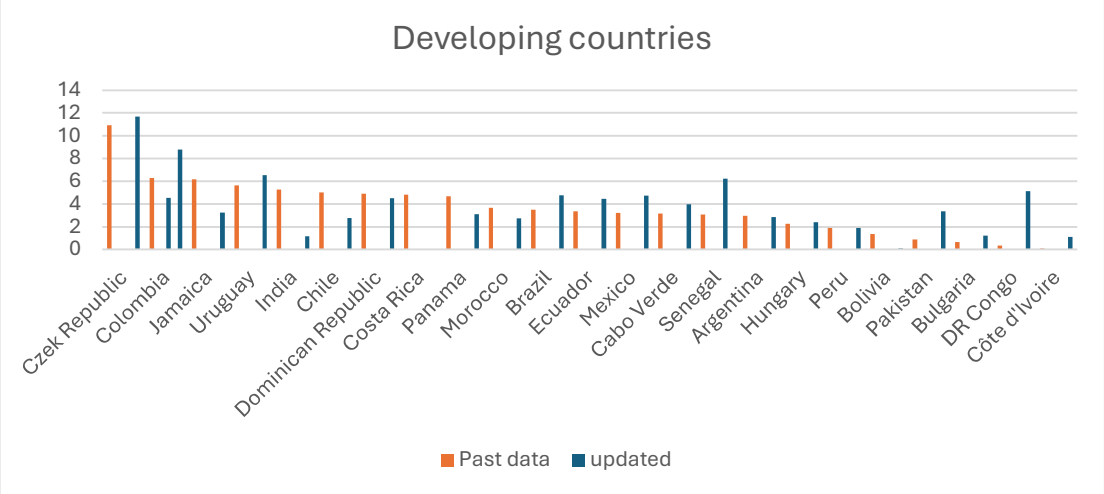
**Figure 1a - Tax Expenditures in Developed Countries (percent of GDP)**




**Source**: Global Tax expenditures Database. "Past data" is based on 2013; "Updated" is based on 2021.

Figure 1b shows the comparison for developing countries.

**Figure 1b - Tax Expenditures in Developing Countries (percent of GDP)**




**Source**: Global Tax expenditures Database. "Past data" is based on 2011, except Panama (Hungary) where it is based on 2012 (2013); "Updated" is based on 2022 except Colombia (Senegal), that is based on 2019 (2021).

[3] Developed (Developing) Economies correspond to the category of Advanced (Developing and Emerging) Countriies at IMF World Economic Outlook (WEO). In 2009 Czeck Republic classification at WEO changed from developing to advanced economy (e.g., in most sample years it belonged to the Developing Countries group).

In general, there is a trend for an increasing ratio of tax expenditures to GDP ratio in developing countries (with a few exceptions), who are also characterized by a wide range – between 11.7 percent (Czel Republic) and 1.1 percent of GDP (Cote d'Ivoire). This paper is among the first to investigate the cyclicality of tax expenditures on an international perspective, utilizing reliable data.

## 2. Literature Survey

### 2.1 Research on tax expenditures

Swift (2006) presents the basic benchmark of tax expenditures, including the concept and definition, size, effects, and the framework for fiscal accountability and transparency. The basic conclusion of his analysis is that current practices in tax expenditures do not fulfill the desired principles of fiscal accountability and transparency according to the Campos/Pradhan (1996) fiscal accountability model and the IMF's fiscal transparency code. His main finding is that the practices related to tax expenditures in most countries should be strengthen when the main problem is at a very basic level: publication of current decisions and implications.

Redonda and Neubig (2018) present a detailed description of tax expenditures in different countries (G20 and OECD countries). They document that a list of advanced economies report in a current and systematic basis the developments on tax expenditures – including Australia, Austria, Canada, France, Germany, Italy, Netherlands, Korea and Sweden. On the opposite situation, i.e., no systematic report, we find a heterogeneous list of countries including China, Czech Republic, Indonesia, Japan, Luxembourg, Russia, Saudi Arabia and Slovenia. Finally, the vast majority of countries report tax expenditures in a Basic Report which does not necessarily have a fixed periodicity. This list of countries includes Belgium, Chile, Iceland, Ireland, Israel, Norway New Zealand, UK, US, and many other OECD countries. These authors stress the importance of transparency on this subject, including the need of reassessing tax expenditures in retrospective.

An analysis of the general equilibrium impact of tax expenditures on employers and employees is presented by Zax (1988). He shows that the impact differs according to the decision of the social planner, depending on the implementation that can be or cannot be budget balanced. Lenjosek (2004) analyzes with explicit formulas the distortions created by consumption tax expenditures. One notable distortion comes

from market diversion, since the tax expenditure implies an increase in consumption of the benefited product at the expense of a reduction in demand of the substitutes (close or far). This author shows explicit formulae for calculating the distortion. The main formula shows that the distortion increases for products that cause market diversion and is directly related to the ratio between the adopted tax expenditure and the relevant general tax rate.

Mare, Porcelli, and Bidolli (2024) recently studied the impact of tax expenditures among Italian municipalities, developing a composite indicator that captures dimensions of progressivity, relevance, and territorial equity. Their findings highlight significant potential for rationalizing both the number and size of tax expenditures, as well as a notable correlation between the geographical distribution of certain tax expenditures.

Similarly, Aliu and Redonda (2024) analyzed social tax expenditures in both advanced and developing economies. They emphasize the importance of integrating tax expenditure transparency into the budget cycle, and advocate for fostering active discussions on social tax expenditures to ensure a sustainable and well-informed decision-making process.

### 2.2 Cyclicality of budget items in developing and developed countries

The literature documents a difference in the way developed countries act compared to developing countries. Aghion and Marinescu (2008) show that developed economies act countercyclically, allowing for a better way to cope with shocks and positively influencing growth. Ilzetzky and Vegh (2008) show that in developing countries policy is typically pro-cyclical, which is in detriment of public welfare.

Counter-cyclicality in developed countries has been documented in many contributions. Lane (2003) shows that fiscal policy as represented by deficits is counter-cyclical. Sorensen and Yosha (2021) show that budget deficits in the US states are counter-cyclical, with increases in both revenue and spending (with the first one dominating) in upturns, and reductions in both revenues and spending (with the first one dominating). Note however, that the different components are separately pro-cyclical, reflecting the dependence of revenues in the GSP and the existence of transfers that are related to the GSP.

Procyclicality in developing economies has been extensively documented. Hausmann et al. (1996) report procyclical fiscal policies in Latin American countries, which they attribute to limited creditworthiness. This phenomenon is further characterized by Talvi and Vegh (2005), who link procyclicality to politically motivated government spending during periods of economic expansion. Strawczynski and Zeira (2011) argue that one contributing factor is the prolonged nature of business cycles in developing countries, which can cause cyclical fluctuations to resemble long-term trends. However, in recent years, several studies document improvements—or "graduation"—in the fiscal behavior of developing countries, resulting in reduced procyclicality (Frankel, Vegh and Vuletin, 2013).

Regarding budget components, most contributions focus on overall deficits and rarely examine expenditure and statutory tax rates separately. An exception is Vegh and Vuletin (2015), who study the cyclicality of statutory tax rates in developed economies and find that procyclicality is particularly evident in indirect taxation. Jalles (2021) examines the cyclicality of spending items in developed economies, documenting notable countercyclicality that has become increasingly pronounced over time.

Explanations for these policy differences generally attribute countercyclical behavior in developed economies to deliberate efforts to stabilize the economy during recessions, which are balanced by similar patterns during expansions to prevent a secular rise in government debt. In contrast, developing countries face binding debt constraints that limit their ability to implement countercyclical policies in downturns, thereby forcing procyclical behavior through spending cuts and increases in statutory tax rates. Vegh and Vuletin (2011) further note that in situations of severe economic decline, the IMF may impose additional fiscal restrictions as part of stabilization programs, reflecting the need to comply with conditionality associated with international support.

Country-level analyses often provide richer insights into the use of specific policy instruments. Strawczynski (2014) shows that, in contrast to overall fiscal policy, governments tend to adopt a procyclical stance when adjusting indirect statutory tax rates, including VAT, gasoline, and cigarette taxes. More recently, So (2025) finds that in New Zealand, countercyclical fiscal behavior was evident during the 1990s and 2000s, but the COVID-19 shock disrupted this pattern, temporarily halting

countercyclical policy—an outcome that contrasts with experiences in most other countries.

Finally, a paper by Alt and Lansen (2006) checks whether there is a correlation between transparency and budget deficits. They found that the higher the lack of transparency, the higher budget deficits are. This result is relevant for the subject being investigated, since a clear characteristic of tax expenditures is their lack of transparency in real time reporting.

### 2.3 Research on cyclicality of tax expenditures

Listokinn (2012) is one of the single papers that investigated qualitatively the relationship between tax expenditures in the US and the business cycles. His analysis differentiates between destabilizing tax expenditures (exclusion for employer-provided health insurance, tax deductibility of mortgage interest, tax expenditure for charitable giving, deductibility of state income tax payments and tax expenditures for investment). tax expenditures with stabilizing or neutral effects (countercyclical expenditures, 401 (k) saving plans and other saving incentives) and standard tax expenditures with phase-outs (standard deduction of income tax, phasing out of programs like EITC). His analysis stresses that tax expenditures belonging to the first group are expected to be exacerbated in expansions, since many of the tax expenditures are subject to the cycle.

Strawczynski (2023) examined the cyclicality of tax expenditures in Israel and identified a structural break in government behavior related to its approach toward budget deficits. In the period before 1997—which included various crises, such as the early-1980s hyperinflation—tax expenditures were pro-cyclical during downturns and countercyclical during upturns. This pattern shifted after 1997, following several budget management reforms that led to a substantial reduction in the government debt-to-GDP ratio. In the post-1997 period, tax expenditures became countercyclical in downturns and pro-cyclical in upturns. Although this approach is expansionary in both phases of the cycle, the author's simulations indicate that the resulting deficit over a full business cycle is minimal and can be easily corrected through feasible budget deficit cuts.

## 3. Estimating cyclicality of tax expenditures: rates of change

Business cycles can be characterized using two principal approaches: the rate-of-change approach and the level (or deviation-from-trend) approach. As discussed in

Appendix A, both frameworks permit the classification of phases into expansions and recessions. Under the rate-of-change approach, expansions are defined as periods of positive GDP growth, whereas recessions are identified by negative growth rates. By contrast, the level approach evaluates actual GDP relative to its estimated trend or potential output. When output exceeds trend, the economy is classified as being in expansion; when it falls short of trend, the economy is in recession. This distinction parallels the methodologies emphasized in the business cycle dating literature, most notably the classical-cycle definition of Burns and Mitchell (1946) and the growth-cycle perspective adopted in later studies (Lucas, 1977; Stock & Watson, 1999; NBER, 2010).

**3.1 Data**

A well-known challenge regarding tax expenditures is the lack of transparent and regularly published data at the country level. Aliu, Redonda and von Haldenwang (2021) compiled consistent information for a sample of developing and developed countries, resulting in the *Global Tax Expenditures Database* (GTED). This dataset is publicly available online and updated annually, drawing on information reported by national Ministries of Finance. For countries that do provide data, reporting is generally consistent and conducted on a yearly basis. However, many countries adopt a non-transparent approach and choose not to report such information. Appendix B presents the evolution of real tax expenditures over the sample period, between 1990 and 2024. There are two main challenges for using this data: i) The data draws on official and publicly available information, namely official tax expenditure reports published by governments worldwide[4]; in fact, tax expenditures do not represent an observed transaction but rather an estimate of the revenue that would have been collected in the absence of the exemption. As a result, these estimates may themselves exhibit cyclical behavior, potentially being positively or negatively correlated with the phase of the business cycle. To address this issue, I include in all my regressions a dummy variable indicating the cycle phase, which takes the value of 1 during expansions and 0 otherwise.[5] ii) Reporting may be biased by frequent changes in the way the calculation

[4] The sample includes countries that have never issued an official tax expenditure report on tax expenditures since 1990 (the first year for which the GTED gathers data).

[5] Ideally, I would prefer an explained variable that is based the increase/decrease in the generosity of tax expenditures (TE), as done by Strawczynski (2024) for the case of Israel. Since

is performed; this bias can be treated by using a dummy variable that accounts for significant changes in the calculation method. For this purpose I will use reported changes by different countries and major jumps that are not explained by economic factors, like Covid-19 and its aftermath.

### 3.2 The endogeneity problem

A well-known problem of the methodology for estimating cyclicality is that tax expenditures and GDP changes are highly correlated, creating an endogeneity issue. We cope with this issue in a similar way as Ilzetski and Vegh (2008), i.e. using an instrumental variable that is correlated with the GDP and not correlated with tax expenditures. For this purpose I use real exports, profiting the fact that since globalization all countries in the sample are widely open, implying a crucial role for exports in GDP produced. To check the validity of this exogenous instrumental variable I perform a Sargan test with exports being included contemporarily and with one lag as an instrumental variable in a regression of log(real tax expenditures) to log(real GDP). I run a Two Stages Least Squared regression. Results are shown in Table 1.

**Table 1a – Exogeneity test for the instrumental variables – Developed Countries**

**Dep. variable: TaxExp_1; Instruments: contemporaneous and lagged real exports**

| Variable | Coefficient | t-statistic | Significance |
|---|---|---|---|
| C | -114.0 | -1.3 | 0.18 |
| Log(RGDP_Developing) | 0.09 | 1.64 | 0.1 |
| AR(1) | 1.1 | 22.8 | 0.00 |
| AR(2) | -0.1 | -0.02 | 0.00 |
| Adjusted R squared | 0.95 | | |
| Durbin Watson | 1.97 | | |
| P-Value of the Sargan J Statistic | 0.6 | | |
| Observations | 448 | | |

performing this task for all countries in the sample would require data that is not available. Therefore, the inclusion of this dummy variable is meant to capture changes in the benchmark tax system against which TEs are measured (e.g. if you change the VAT statutory rate, revenue forgone mechanically changes) and changes in the tax base (e.g. cost of capital gains exemption for first residences increases as prices of real state rises in real terms even if the underlying policy remains unchanged).

**Table 1b – Exogeneity test for the instrumental variables – Developing Countries**

**Dep. Variable: TaxExp_2; Instrument: contemporaneous and lagged real exports**

| Variable | Coefficient | t-statistic | Significance |
|---|---|---|---|
| C | 70.9 | 2.3 | 0.03 |
| Log(RGDP_Developed) | 0.0009 | 4.1 | 0.00 |
| AR(1) | 0.99 | 17.0 | 0.00 |
| AR(2) | 0.19 | 2.9 | 0.00 |
| Adjusted R squared | 0.94 | | |
| Durbin Watson | 2.1 | | |
| P-Value of the Sargan J Statistic | 0.53 | | |
| Observations | 301 | | |

Results are backing the use of real exports as a valid instrument since its values are not correlated with the residuals according to the J Statistic of Sargan. In Appendix Tables A.1 and A2 I show the results of main cyclical characteristics for both developed and developing countries.

Consistent with the different definitions of cycles, I characterize cyclical behavior using two different techniques for rates of change and a third one considering deviations from trend. The expected impact of explaining variables is described in Appendix C.

Another caveat that should be explicitly noted is that performing panel regressions entails identifying common patterns within the groups of developed and developing economies, respectively. As a result, the findings reflect group-level tendencies and may not apply to each country individually.[6]

I conclude this sub-section by noting that all three critics of Jaimovich and Panizza (2007) are taken into account in this paper: i) with respect of developing group of countries, 9 countries belong to the illegitimate group (middle high income countries) and 15 countries belong to the one that is considered by these authors as legitimate (middle low and low income countries); i.e., the vast majority. Concerning the explained variable, tax expenditures has similar characteristics to government expenditure and not to the budget deficit; and concerning the instrumental variable, I use the same one as chosen by these authors.

[6] This caveat means that to understand cyclicality at a particular country a dedicated regression analysis is required. Strawczynski (2024) shows, that in the case of Israel, the cyclicality pattern markedly changed after 1997.

### 3.3 Cyclicality of tax expenditures: rates of change

Two main techniques are employed to characterize cyclical behavior using rates of change. The first is the pure *rate-of-change approach*, in which recessions are defined as periods of negative growth rates and expansions as periods of positive ones, as discussed above. The second is the *cointegration-based approach*, which relies on short-run error-correction regressions of tax expenditures rates of change that incorporate lagged deviations from the long-run cointegration relationship.

#### 3.3.1 Developed countries

Table 2 presents the results of regressions in which the primary coefficients of interest—instrumented constant GDP growth rates during recessions and expansions—are statistically significant. Where necessary, autoregressive terms are included in all regressions to mitigate potential autocorrelation. In the first regression, I include all key government budget variables that could influence decisions regarding tax expenditures: revenues, expenditures, and gross debt. Only expenditures are statistically significant, with the expected sign—an increase in government spending crowds out tax expenditures. Among the additional explanatory variables, I include the rate of change in PM25 emissions (a harmful pollutant), which may capture tax expenditures aimed at improving air quality, as well as the share of urban population and population growth, both modeled under non-linear hypotheses. The signs of the coefficients are as expected. Increases in PM25 exposure reduce tax expenditures, as pollution is addressed through more direct regulatory measures (e.g., production limits). The effect of urban population is negative at low levels, meaning that governments do not need to create incentives to live in the periphery, and strongly positive at higher levels, reflecting the government's incentive to encourage settlement in peripheral areas. Population growth has a positive effect at low rates and a larger negative effect at higher rates, possibly due to other policy measures taken under rapid population expansion. In the fourth regression, I use a summary fiscal variable based on net primary lending (i.e., excluding interest payments). Across all specifications, the models perform well in terms of serial correlation (Durbin–Watson statistic) and exogeneity (Sargan J statistic), though the overall model fit is moderate (adjusted $R^2$). Results indicate that tax expenditures are countercyclical during both expansions and recessions, with a statistically significant coefficient, mostly at the 5% level.

Concerning the clustered standard deviations I used in the first column cross section weights, and then checked robustness by using white period cross section clustered

standard deviations. In column 3 I add a dummy that considers reporting changes by governments in the sample[7]. Main results remain significant, with a reduction in the coefficient of counter-cyclical policy in expansions. Since controlling for reporting changes is crucial, I look at this regression as the most indicative in this table.

**Table 2 – Developed countries – Rates of change**

(in parenthesis: clustered standard deviations#)

| Variable | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| C | -0.04 (0.03) | -0.05 (0.0)* | -0.06 (0.03)** | -0.03 (0.03) |
| dlog(Y)*expansions | -1.1 (0.5)** | -1.2 (0.5)** | -1.0 (0.5)* | -1.9 (0.6)*** |
| dlog(Y)*recessions | -1.3 (0.7)** | -1.4 (0.6)** | -1.7 (0.6)** | -1.2 (0.6)** |
| Expansions | 0.07 (0.03)** | 0.07 (0.02)*** | 0.08 (0.03)** | 0.08 (0.04)** |
| dlog(Primary Lending) | | | | -2.3e-5 (2.8e-6) |
| dlog(gov_revenue) | -0.09 (0.2) | -0.08 (0.2) | 0.09 (0.2) | |
| dlog(gov spending) | -0.4 (0.1)*** | -0.4 (0.1)*** | -0.44 (0.09)*** | |
| dlog(gov gross debt) | -0.05 (0.1) | -0.06 (0.2) | -0.06 (0.2) | |
| dlog(PM25) | -0.4 (0.2)*** | -0.4 (0.1)*** | -0.34 (0.1)*** | -0.17 (0.2) |
| dlog(Urban_Pop_percent) | -9.5 (2.3)*** | -9.6 (3.3)*** | -8.0 (2.8)** | -10.5 (3.3)*** |
| dlog(Urban_Pop_Percent)^2 | 556.9 (213)*** | 561.9 (262.5)** | 403.2 (221.1)* | 615.5 (247.7) |
| dlog(pop) | 12.9 (3.7)*** | 12.5 (2.5)*** | 10.7 (2.5)*** | 14.0 (2.6)*** |
| dlog(pop)^2 | -575.6 (284.5)** | -583.1 (170.7)** | -471.9 (169.8)** | -854.0 (193.2)*** |
| Dummy for Report changes | | | 1.3 (0.4)*** | |
| Adjusted R Squared | 0.09 | 0.09 | 0.04 | 0.05 |
| Durbin Watson Statistic | 1.99 | 1.99 | 1.98 | 1.98 |
| Sargan J | 0.63 | 0.67 | 0.65 | 0.84 |
| Number of Observations | 245 | 245 | 245 | 245 |
| Coefficient covariance method | Cross section weights | White period (C.S. Cluster) | White period (C.S. Cluster) | White period (C.S. Cluster) |

# All regressions include country fixed effects and are cross-sectionally weighted. All regressions include auto-regressive components; the instrumental variable for constant prices GDP is the constant prices exports with one and two lags. Instrumental variables for other explaining variables are their lagged value.

[7] Changes in reporting are identified based on information disclosed in countries' public reports, as identified by the Tax Expenditures Lab team (publisher of the GTED), as well as by large jumps in the data, excluding the Covid-19 years. The latter are excluded because large fluctuations during this period primarily reflect temporary closures or subsequent declines and recoveries in activity. I thank Agustin Redonda and Flurim Aliu for their collaboration on this matter.

The second method that I use considers a cointegration long-run relationship (see the characterization of series degree of integration in Appendix C). The lagged residual of this regression is included in the short-run regressions, which are reported in Table 3. I expect the lagged residual to be negative and between 0 and 1, which would act as an additional testimony of the coherence of the long-run relationship between explained and explaining variables

**Table 3 – Developed countries – Cointegration shot run regression**

(in parenthesis: clustered standard deviations)#

| Variable | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| C | 0.019 (0.03) | 0.025 (0.03) | 0.027 (0.05) | 0.01 (0.03) |
| dlog(Y)*expansions | -1.4 (0.6)** | -1.5 (0.6)** | -0.95 (0.56)* | -1.4 (0.7)** |
| dlog(Y)*recessions | -1.4 (0.7)* | -1.4 (0.8)* | -2.2 (1.1)** | -1.7 (0.9)** |
| Expansions | 0.05 (0.025)* | 0.05 (0.022)** | -0.01 (0.03) | 0.07 (0.03)*** |
| dlog(Government Expenditure) | -0.05 (0.16) | -0.14 (0.18) | 0.83 (0.2)*** | -0.2 (0.2) |
| dlog(Government Revenue) | 0.31 (0.32) | 0.16 (0.51) | 1.1 (0.3)*** | -0.2 (0.4) |
| dlog(Government Gross Debt) | -0.2 (0.16) | -0.24 (0.12)* | -0.9 (0.4)** | -0.2 (0.2) |
| Lagged long-term eq. Residual | -0.14 (0.03)*** | -0.14 (0.03)*** | -0.3 (0.03)*** | -0.14 (0.03)*** |
| dlog(Greenhouse gases emission) | 0.27 (0.31) | 0.4 (0.3) | 0.6 (0.3)* | 0.34 (0.3) |
| d(inflation average) | -0.003(0.003) | -0.002 (0.003) | -0.005 (0.005) | 0.001 (0.003) |
| dlog(Urban_Pop_percent) | | | | -1.1 (1.5) |
| Dummy for Report changes | | | 1.1 (1.0) | |
| Adjusted R Squared | 0.06 | 0.02 | 0.9 | 0.05 |
| Durbin Watson Statistic | 2.0 | 2.0 | 1.8 | 1.96 |
| Sargan J | 0.86 | 0.99 | 0.46 | 0.69 |
| Number of Observations | 300 | 326 | 300 | 281 |
| Coefficient covariance method | White period (cross-section cluster) | Cross section weights | Cross section weights | Cross section weights |

# All regressions include country fixed effects and are cross-sectionally weighted. All regressions include auto-regressive components; the instrumental variable for constant prices GDP is the constant prices exports with one and two lags. Instrumental variables for other explaining variables are their lagged value.

In fact, in all regressions the coefficient of the lagged residual is significant and with expected characteristics.

I use for this method a similar list compared to Table 2, including in addition changes in inflation, which are correlated with macroeconomic instability. I also check

robustness to the report dummy, which turns to be non-significant and reduces the explanation power, while not changing the main result: I found significant evidence of counter-cyclical tax expenditures in both expansions and recessions, the latter being more substantive when compared to Table 2.

### 3.3.2 Developing countries

In Appendix D, I present a model predicting that developing economies may adjust tax expenditures pro-cyclically. This behavior arises because rating agencies tend to demand fiscal adjustments during recessions to address rising deficits caused by declines in revenue as GDP falls. Such pressures create significant challenges for these economies. Since tax expenditures are not transparent and are not reported in the budget in real time, governments in developing countries may seek to expand them during periods of economic growth, when deficits are reduced due to higher revenues. Consequently, I expect positive coefficients for tax expenditures in both expansions and recessions, with the latter reflecting the need to contain deficits during economic downturns. This procyclical policy is due to debt constraints, since the need for emitting new bonds forces governments to implement a contractionary fiscal policy.

The same specification used for developed economies is applied here, with the addition of controlling variables that are more relevant for developing economies. Results for the rates of change are reported in Table 4.

In the baseline regression, which includes government budget variables, the diagnostic statistics (Adjusted R-squared, Durbin–Watson, and J. Sargan tests) are satisfactory. Among the explanatory variables, only government expenditures are statistically significant, with a positive coefficient, indicating that higher expenditures are correlated with higher tax expenditures. This result is consistent with the model shown in Appendix D, which shows that we expect a substitution pattern for developed countries and a complementary pattern for developing countries. Procyclicality is highly significant and with a large coefficient: tax expenditures rise sharply during expansions and are cut abruptly during recessions. This pattern was also found in the literature for government expenditures (see Strawczynski and Zeira, 2011).

The second regression re-estimates the specification using a dummy for potential reporting changes. This dummy variable is significant and re-affirms the result obtained in the first regression, with a reduction in the coefficient of procyclicality in expansions.

In the third regression two variables are introduced. first, population growth rate, which is negative and significant at the 10 percent level; this suggests lesser need for tax expenditures directed toward peripheral populations as population growth accelerates. Greenhouse gas emissions coefficient is negative and significant, hinting that tax expenditures are substituted by other tools as air quality diminishes. The second variable is a moving average of net debt, capturing solvency. Finally, in the fourth regression I check whether changes in democracy alter results. Findings remain robust, consistently showing a remarkable pro-cyclical pattern of tax expenditures in both expansions and recessions. I also changed in this regression the cluster method, which did not affect the significance of main results.

**Table 4 – Developing countries – Rates of change**

(in parenthesis: clustered standard deviations)#

| Variable | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| C | 0.2 (0.1)* | 0.2 (0.1)* | 0.14 (0.08) | 0.14 (0.07)* |
| dlog(Y)*expansions | 3 (1.03)*** | 2.1 (1.2)* | 2.2 (0.6)*** | 2.2 (0.6)*** |
| dlog(Y)*recessions | 2.9 (1.2)*** | 3.1 (1.2)*** | 1.9 (0.8)** | 2.95 (0.9)** |
| Expansions | -0.3 (0.1)*** | -0.2 (0.1)* | 0.17 (0.06)** | -0.3 (0.07)** |
| dlog(Governement Spending) | 0.05 (0.3) | 0.07 (0.3) | 1.1 (0.6)** | 0.5 (0.27)* |
| dlog(Government Revenue) | -0.36 (0.51) | -0.3 (0.5) | 0.32 (0.38) | 0.13 (0.31) |
| dlog(Government Gross Debt) | -0.04 (0.11) | -0.06 (0.12) | -0.13 (0.11) | 0.09 (0.14) |
| dlog(Greenhouse gas emissions) | 0.2 (0.5) | -0.4 (0.6) | -0.1 (0.4)* | 0.06 (0.7) |
| dlog(population) | | | -9 (4.6)* | |
| Moving average(net debt,3) | | | 0.0009 (0.1) | |
| d(democracy) | | | | 0.004 (0.04) |
| Dummy for Report changes | | 0.37 (0.12)*** | | |
| Adjusted R Squared | 0.13 | 0.013 | 0.17 | 0.12 |
| Durbin Watson Statistic | 2.3 | 2.3 | 2.2 | 2.0 |
| Sargan J | 0.9 | 0.7 | 0.9 | 0.8 |
| Number of Observations | 313 | 313 | 202 | 151 |
| Coefficient covariance method | Cross section weights | Cross section weights | Cross section weights | White 2-way |

# All regressions include country fixed effects and are cross-sectionally weighted. All regressions include auto-regressive components; the instrumental variable for constant prices GDP is the constant prices exports with one and two lags. Instrumental variables for other explaining variables are their lagged value.

As in the analysis for developed countries, I now turn to the cointegration tests. The results are presented in Table 5. In all regressions, the lagged residual is statistically significant, lies between 0 and 1, and has a negative coefficient. Consistent with the previous analysis, I also include the rate of population growth (equations 2 to 4), which again yields negative and statistically significant coefficients. The most notable result in this table is that pro-cyclicality continues to be strong, but it is clearly stronger during expansions than during recessions. However, this result is not confirmed by the Wald test, which is only marginally significant (at 17 percent) when tested using column 1. In column 3 I performed the regression correcting for potential report changes and obtained that the explaining power of the regression does not change, and that results concerning cyclicality remain significant.

**Table 5 – Developing countries – Cointegration**

(in parenthesis: clustered standard deviations)#

| Variable | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| C | -0.003 (0.03) | 0.06 (0.05) | 0.05 (0.05) | 0.05 (0.04) |
| dlog(Y)*expansions | 2.03 (0.5)*** | 2.2 (0.5)*** | 2.1 (0.5)*** | 2.1 (0.6)*** |
| dlog(Y)*recessions | 1 (0.6)* | 1.22 (0.7)* | 1.3 (0.7)* | 1.3 (0.4)*** |
| Expansions | -0.07 (0.03)** | -0.1 (0.05)** | -0.1 (0.04)** | -0.1 (0.02)*** |
| dlog(Government Expenditure) | 0.2 (0.16) | 0.23 (0.13)* | 0.23 (0.13)* | 0.22 (0.14) |
| dlog(Government Revenue) | 0.08 (0.14) | 0.15 (0.14) | 0.14 (0.14) | 0.14 (0.12) |
| dlog(Government Gross Debt) | 0.09 (0.11) | 0.05 (0.11) | 0.06 (0.11) | 0.06 (0.12) |
| Lagged long-term eq. Residual | -0.04 (0.02)* | -0.06 (0.03)** | -0.05 (0.03)* | -0.05 (0.02)* |
| dlog(Greenhouse gases emission) | 0.3 (0.24) | 0.12 (0.26) | 0.09 (0.27) | 0.09 (0.37) |
| dlog(population) | | -3.3 (1.98)* | -3.5 (1.95)* | -3.5 (1.5)** |
| Dummy for Report changes | | | 0.04 (0.04) | 0.04 (0.05) |
| Adjusted R Squared | 0.2 | 0.19 | 0.19 | 0.19 |
| Durbin Watson Statistic | 2.0 | 2.2 | 2.2 | 2.2 |
| Sargan J | 0.85 | 0.97 | 0.96 | 0.96 |
| Number of Observations | 199 | 218 | 218 | 218 |
| Coefficient covariance method | Cross Section weights | Cross Section weights | Cross Section weights | White 2-way |

# All regressions include country fixed effects and are cross-sectionally weighted. All regressions include auto-regressive components; the instrumental variable for constant prices GDP is the constant prices exports with one and two lags. Instrumental variables for other explaining variables are their lagged value.

To check whether high-income developing countries influence cyclicality, I checked regression 3 after excluding the highest per-capita income countries: Czechia, Hungary and Uruguay. I found that procyclicality turns insignificant in expansions and substantially rises in recessions (coefficient rises to 2.8; significant by Wald test).

**3.4 Levels: deviations from trend**

As shown in Appendix A, an alternative definition of cycles can be obtained by examining levels — specifically, whether tax expenditure levels and explaining variables levels lie above or below their estimated trend. For this purpose, I use a linear trend. An expansion (recession) is defined as a value that is above (below) the trend explanatory variables. I then examine whether these deviations account for the deviations from trend in tax expenditures.

**3. 4.1 Developed countries**

Results for developed economies are shown in Table 6.

The first regression employs a specification with basic government variables, augmented by life expectancy. The overall regression diagnostics are satisfactory: the explained variance, as captured by the adjusted R-squared, is high; the Durbin–Watson statistic is close to 2, indicating no serious autocorrelation; and the Sargan test for exogeneity yields a p-value well above 0.05. The main finding is related to actual cyclicality of tax expenditures. There is evidence of a clear countercyclical policy in both expansions and recessions, significant at the 10 percent level. These results are confirmed in Regression 2 when including the dummy for reporting changes, which resulted significant but did not affect the coefficients that characterize procyclicality.

In Regression 3, I introduce the variables of greenhouse gas emissions (significant at 1 percent) and urban population percent (significant at 10 percent). It turned out that under this specification life expectancy becomes significant and negative. A negative coefficient means that tax expenditures are less used for treating increased longevity, which are usually treated by governments increasing the retirement age. Finally, the procyclicality result is reaffirmed in the last regression, where the coefficient covariance method is again adjusted to cross section weights.

**Table 6 – Developed countries – levels: deviations from trend**

(in parenthesis: clustered standard deviations)#

| Variable | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| C | -0.02 (0.05) | -0.01 (0.03) | 0.3 (0.04)*** | 0.3 (0.06)*** |
| Y_dev*expansions | -0.67 (0.38)* | -0.7 (0.35)* | -1.5 (0.2)*** | -1.5 (0.3)*** |
| Y_dev*recessions | -0.72 (0.39)* | -0.75 (0.36)* | -1.5 (0.2)*** | -1.5 (0.3)*** |
| Expansions | 0.1 (0.08) | 0.08 (0.07) | -0.03 (0.02) | -0.03 (0.02) |
| Governement Spending dev. | 0.05 (0.1) | 0.09 (0.2) | 0.17 (0.08)* | 0.17 (0.08)** |
| Government Revenue dev. | 0.29 (0.19) | 0.29 (0.17) | 0.18 (0.1)* | 0.18 (0.1)* |
| Government Gross Debt dev. | 0.06 (0.05) | 0.05 (0.04) | -0.04 (0.03) | -0.04 (0.03) |
| Life Expectancy dev. | -3.3 (2.2) | -3.5 (2.1) | -1.9 (1.4)* | -1.9 (1.6) |
| Greenhouse gas emissions dev. | | | 0.02 (0.007)* | 0.015 (0.01) |
| Urban_Pop_percent | | | 0.8 (0.05)*** | 0.8 (0.02)*** |
| Dummy for Report changes | | 0.4 (0.2)** | | |
| Adjusted R Squared | 0.96 | 0.96 | 0.99 | 0.99 |
| Durbin Watson Statistic | 1.92 | 1.94 | 1.99 | 1.99 |
| Sargan J | 0.74 | 0.84 | 0.28 | 0.28 |
| Number of Observations | 294 | 294 | 253 | 253 |
| Coefficient covariance method | White period (cross-section cluster) | White period (cross-section cluster) | White period (cross-section cluster) | Cross Section weights |

# All regressions include country fixed effects and are cross-sectionally weighted. All regressions include auto-regressive components; the instrumental variable for constant prices GDP is the deviations from trend of constant prices exports with one and two lags. Instrumental variables for other explaining variables are their lagged value.

### 3.4.2 Developing countries

Results for developing countries are shown in Table 7. I start with the basic specification that includes only government budget variables. Interestingly, all government budget variables are significant and display the expected signs. Lower revenues and higher gross debt are associated with reductions in tax expenditures, given the budget constraint. On the other hand, higher spending is linked to increases in tax expenditures, suggesting complementarity, according to the model shown in Appendix D.

In general I find strong and significant evidence of procyclicality (at 1 percent), except for column 4 where significance was obtained at 10 percent. In columns 3 and 4 I

introduce the old-age dependency ratio as an explanatory variable, which proves significant in Regression 4. Its positive effect indicates that part of the policy response to rising old-age dependency operates through tax expenditures. When analyzed together with the previous result on life expectancy, this result hints that when the life expectancy increased affects dependency, there is a need for increasing tax expenditures.

**Table 7 – Developing countries – levels: deviations from trend**

(in parenthesis: clustered standard deviations)#

| Variable | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| C | -36.2 (15.2)* | -38.2 (11.7)*** | -1.7 (57) | -1.7 (51.6) |
| Y_dev*expansions | 337.6 (86.1)*** | 354.4 (91.7)*** | 456.7 (198.2)*** | 456.7 (225.8)* |
| Y_dev*recessions | 327.6 (94.4)*** | 337.9 (99.4)*** | 474.4 (227.9)*** | 474.4 (255.6)* |
| Expansions | -24.8 (15.1) | -24.3 (14.8) | -34.1 (42.2) | -34.1 (37.1) |
| Governement Spending dev. | 146.1 (37.5)*** | 169.4 (46.9)*** | 111.0 (58.4)* | 111.0 (63.3)* |
| Government Revenue dev. | -151.6 (61.6)** | -143.6 (68.2)** | -267.4 (142)* | -267.4 (159.4) |
| Government Gross Debt dev. | -91.6 (17.1)*** | -106.2 (21.7)*** | -57.7 (23.6)** | -57.7 (20.4)** |
| Old age dependency ratio dev. | | | 297.6 (207.2) | 297.6 (148.0)* |
| Dummy for Report changes | | -5.0 (8.6) | | |
| Adjusted R Squared | 0.95 | 0.94 | 0.93 | 0.93 |
| Durbin Watson Statistic | 0.98 | 0.99 | 0.84 | 0.84 |
| Sargan J | 0.37 | 0.23 | 0.67 | 0.67 |
| Number of Observations | 244 | 244 | 237 | 237 |
| Clustering | Cross section weights | Cross section weights | Cross section weights | White 2-way |

# All regressions include country fixed effects and are cross-sectionally weighted. All regressions include auto-regressive components; the instrumental variable for constant prices GDP is the deviations from trend constant prices exports with one and two lags. Instrumental variables for other explaining variables are their lagged value.

## 4. Summary and conclusions

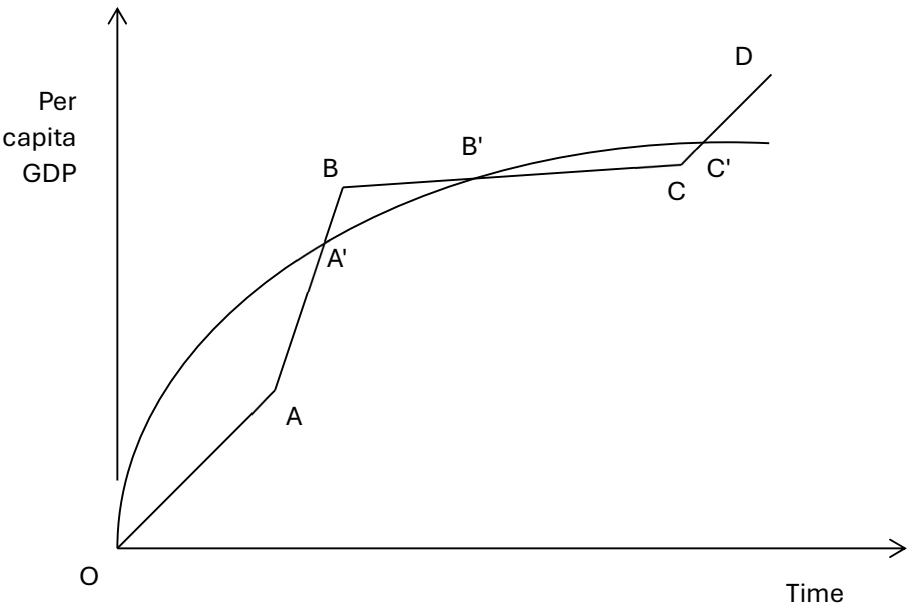
Research on tax expenditures remains limited, largely due to the absence of systematic reporting in both developed and developing countries. This paper provides the first empirical test of whether governments adjust tax expenditures during recessions or expansions using a new database called *Global Tax Expenditures Database*.. Based on a simple model, I expect developing economies to display procyclical behavior,

reflecting the financing constraints they face. In contrast, for developed economies — where countercyclical policy is expected during recessions — I anticipate countercyclical adjustments in both recessions and expansions. Such a policy design would reduce reliance on raising statutory tax rates or cutting government spending in recessions to achieve fiscal balance.

The empirical evidence, based on separate samples of developed and developing economies, supports these expectations. Tax expenditure policies are found to be procyclical in developing countries, with partial evidence that the effect is stronger during expansions. In developed economies, tax expenditure policy is countercyclical, implying that tax expenditures are increased in recessions and cut in expansions.

This study represents a first step toward a deeper understanding of tax expenditure policy in an international context.

**APPENDIX A – Definitions of Cycles**



Suppose that the piecewise linear line in the diagram represents actual GDP, and the curve represents its trend (using an HP filter). Using rates of change of GDP, which is based on growth rates, implies that the periods AB and CD are defined as expansive ("boom") periods – because of the steeper slope, which means a high rate of change; OA and BC are recession periods, since they are characterized by low growth rates.

An alternative definition of growth Is based on GDP level. According to this definition, the growth period starts when the GDP level is higher than trend; i.e., the first expansion period starts at A` (instead of A) and ends at B` (instead of B). The delay concerning the starting date can be interpreted by thinking that the higher growth rate after point A only compensates for the loss of output in the previous recession, and it is only at A` that the expansionary phase of the cycle begins.

In the following tables I show the cyclical characteristics for both developed and developing economies.

**Table A.1 – Cyclical characteristics in Developed Economies** (792 observations)

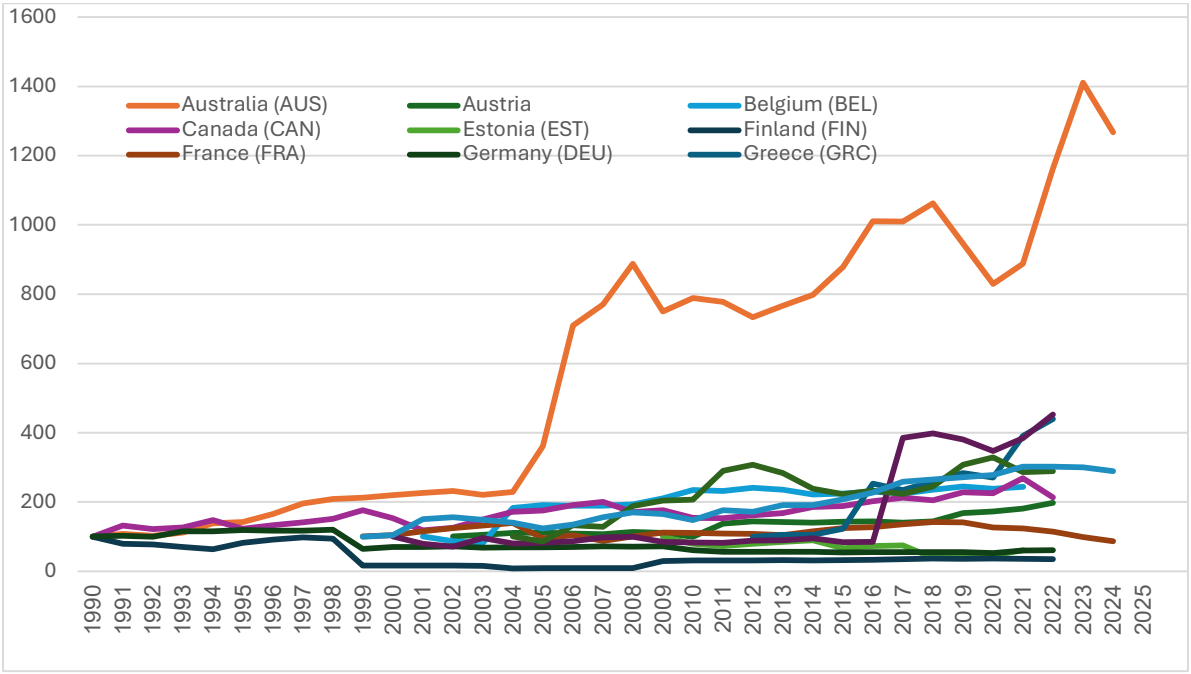
| Variable | Average | Minimum | Maximum | SD |
|---|---|---|---|---|
| dlog(Y) in expansions | 0.027 | 0 | 0.22 | 0.025 |
| dlog(Y) in recessions | -0.003 | -0.17 | 0 | 0.019 |

**Table A.2 – Cyclical characteristics in Developing Economies** (800 observations)

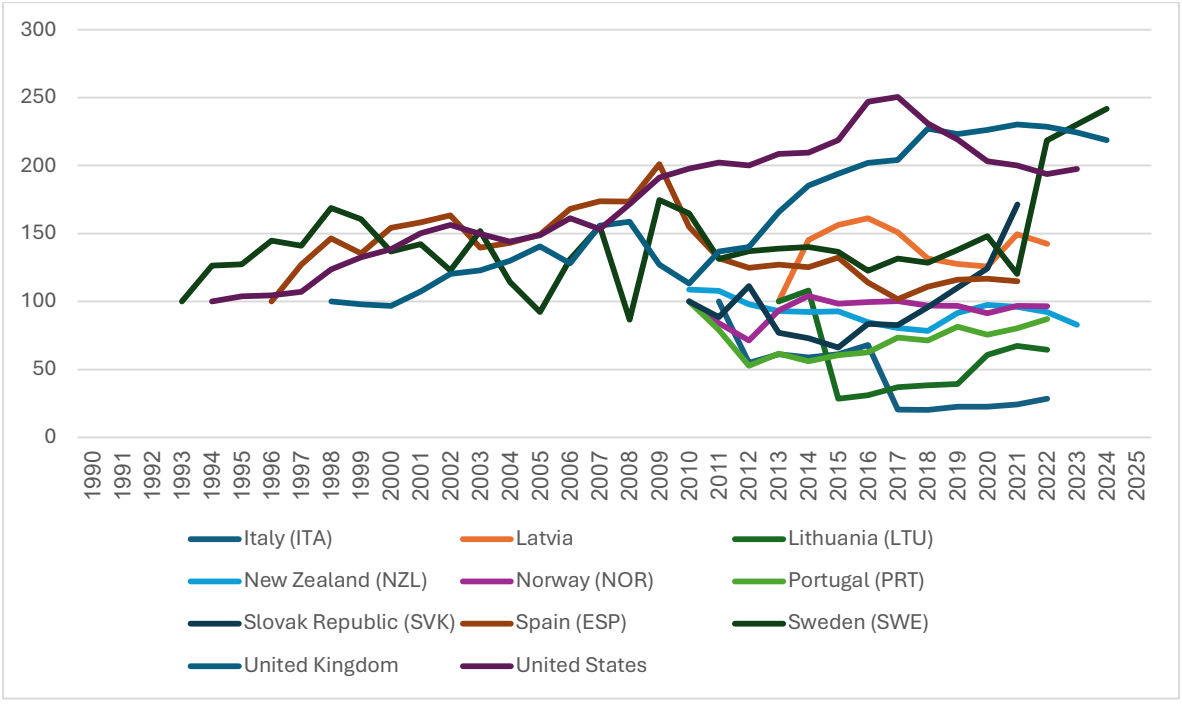
| Variable | Average | Minimum | Maximum | SD |
|---|---|---|---|---|
| dlog(Y) in expansions | 0.038 | 0 | 0.16 | 0.028 |
| dlog(Y) in recessions | -0.006 | -0.219 | 0 | 0.022 |

## Appendix B – Tax expenditures time series

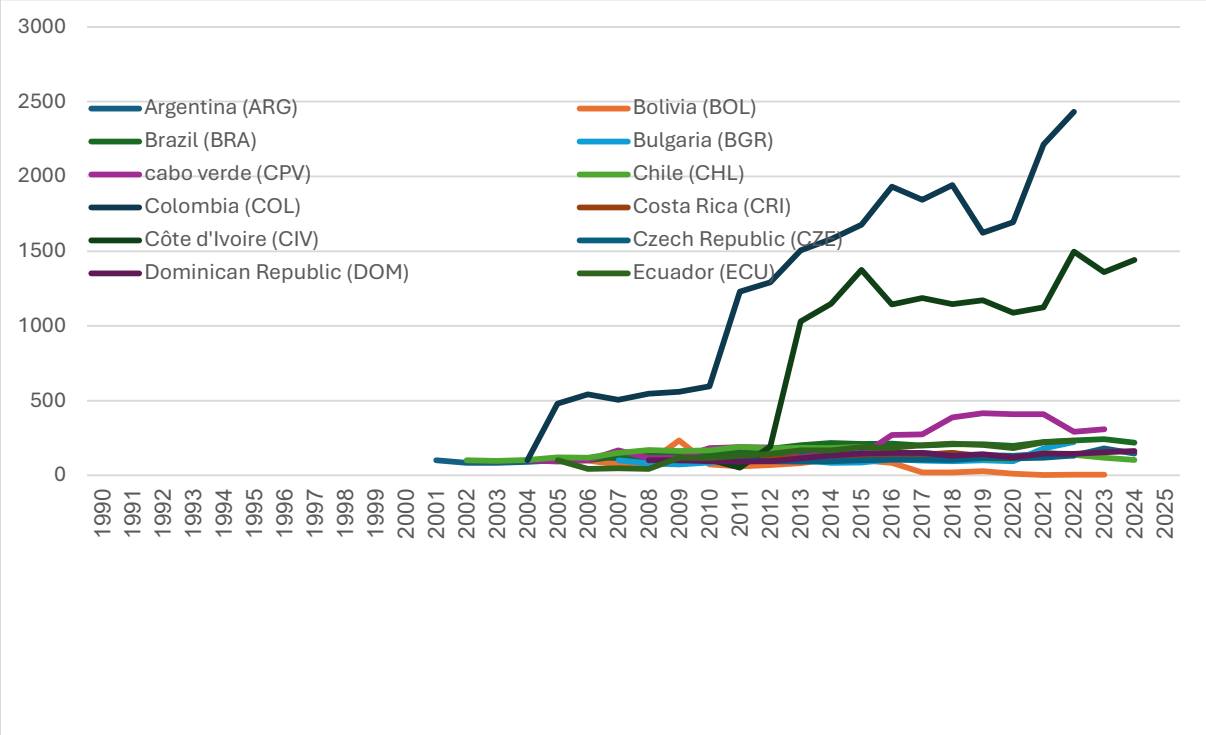
### Developed Countries – Part A



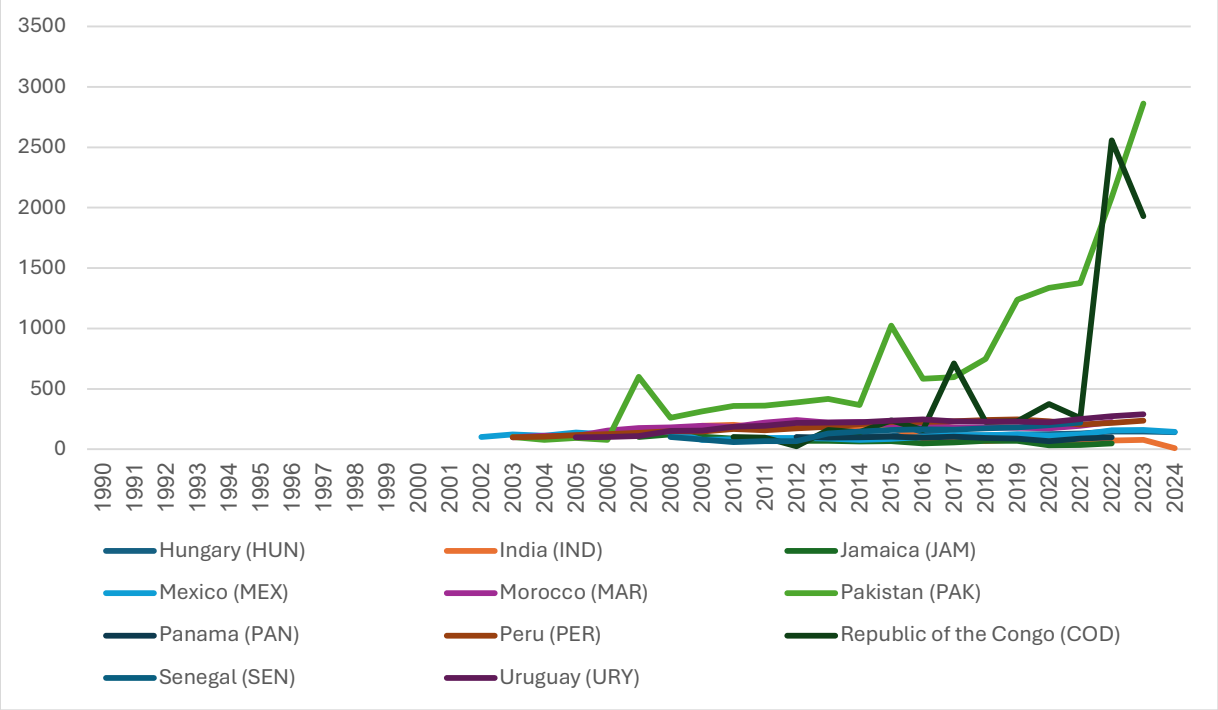

### Developed Countries – Part B



**Developing Countries – Part A**




**Developing Countries _ Part B**



## Appendix C – Unit root tests and expected impact of explaining variables

I checked the integration level of d(X) and dlog(X) to verify the level of integration. The following variables were found to be I(0) using the ADF Fisher criterion, with probability 0:

**Developing countries:** Revenue forgone, real GDP, real exports, real government expenditure, real government revenue, real government gross and net debt, real government net and primary lending, greenhouse gases emissions, PM25 emissions, population, life expectancy, inflation, rural population, young dependency ratio, democracy.

**Developed countries:** Revenue forgone, real GDP, real exports, real government expenditure, real government revenue, real government gross and net debt, real government net and primary lending, greenhouse gases emissions, PM25 emissions, population, life expectancy, inflation.

The following variables were not found to be I(0) and I was constrained to look at the second difference (the probability appears in parenthesis):

**Developing countries:** old dependency ratio (0.000).

**Developed countries:** rural population (0.0234), young dependency ratio (0.22)**,** old dependency ratio (0.0008).

Concerning the expected impact of the explaining variables, the following is the analysis:

Real GDP – According to the model.

Real government expenditure – in developed economies, where institutions are strong, I expect substitution between tax expenditures and government spending (i.e., a negative sign); in developing economies I expect complementary (positive sign).

Real government revenue – In developed countries a high revenue implies a higher government size, including tax expenditures (positive sign); In developing countries I expect the opposite: a high revenue ratio shows strength and proximity to development, which shall be translated into lower tax expenditures (negative sign).

Real government gross and net debt – since debt is considered problematic by rating agencies everywhere, I expect a negative sign in both developed and developing economies.

Real government net and primary lending – similar to debt.

Greenhouse gas and PM2.5 emissions — In developed economies, where the fight against pollution is at an advanced stage, I expect a negative relationship, as pollution reduction is typically achieved through measures other than tax expenditures. In developing countries, by contrast, I expect a positive relationship, since pollution control efforts are more likely to rely on tax expenditures.

Population - In general I expect a non-linear relationship with a positive coefficient for low values (i.e., when population growth is low tax expenditures support population growth) and a negative one for high values.

Life expectancy – similar to population.

Inflation – I use it as an instrument for detecting macroeconomic instability.

Urban residence/population – I expect a non-linear relationship, with a negative coefficient for low values and a positive one for high values, to reflect the need for using specific tax expenditures to incentivize residence in the periphery.

Old-age dependency ratio – I expect a positive coefficient, to reflect the need of using tax expenditures to incentivize pension savings.

## Appendix D - A stylized model

In this model I replicate the process of political decision-making on cyclical fiscal policy by comparing government spending with tax expenditures. Government spending is incorporated into the formal budget and managed in a transparent manner, whereas tax expenditures are more susceptible to manipulation, since they are not reported in real time and are only disclosed subsequently as an annex to the budget.

With respect to the implications of these political choices, rating agencies treat developed economies symmetrically over the cycle; in addition, these economies rely on debt without being dependent on IMF loans, since they are able to sell bond

emissions at normal interest rates at the international bond market. Consequently, for these countries there is no substantive distinction between government spending and tax expenditures in the context of cyclical policy. By contrast, rating agencies apply stricter standards to developing economies: they react immediately to fiscal imbalances and often call for budget cuts when deficits increase. This mechanism is even stronger when those countries are constrained to ask for an IMF loan.

This asymmetry arises from incomplete information regarding the actual fiscal position. During expansions, tax expenditures can be concealed because they are excluded in real time from the official budget at times when the deficit-to-GDP ratio is low (or even when there is a surplus). Since tax expenditures are reported with a lag, policymakers can exploit this delay in formal markets to obscure the true fiscal stance. We define this asymmetry as the difference between the reported government deficit and the actual government deficit.

The reported government deficit does not incorporate contemporaneous increases in tax expenditures. To formalize this distinction, it is useful to differentiate between the *primary* deficit—defined as government spending plus tax expenditures minus tax revenues—and the *overall* deficit, which additionally includes interest payments on outstanding debt. The corresponding overall reported (represented by supra-index R) budget deficit and debt equations are specified as follows:

(1) $d_1^R = g_1 - \tau Y_1 + r * debt_1$

(2) $debt_1 = debt_0 + d_1$

Where d represents the deficit as a percent of GDP, g represents government spending as a percent of GDP, $\tau$ is the average tax rate, Y is the GDP, r is the real interest rate and debt is government debt in percent of GDP.

In the presence of tax expenditures , actual (represented by supra-index A) overall government budget deficit is defined (assuming that e represents tax expenditures as a percent of GDP) by:

(3) $d_1^A = g_1 + e_1 - \tau Y_1 + r * debt_1$

I now examine the implications for countercyclical fiscal policy in a downturn, after a period with a positive GDP shock (upturn). The key issue is whether the government

responds through tax expenditures or through government spending. Specifically, assume that a positive shock of magnitude ε occurs in period 1, followed by a negative shock of equal magnitude in period 2. This characterization is consistent with the business cycle literature, which documents longer phases of expansion followed by shorter phases of contraction.

**D.1 Developed Economies**

In developed economies, rating agencies adopt a more permissive stance, and governments are not typically required to adjust policies in ways that affect sovereign ratings. From this perspective, there is no substantive difference between reported and actual deficits. Moreover, with respect to debt dynamics, it does not matter whether fiscal policy operates through government spending or through tax expenditures. Thus, for developed economies, the choice of instrument is largely irrelevant.

Formally, the primary deficit (pd) in period 1 is:

$$pd_1 = g_1 + e_1 - \tau(Y_1 + \varepsilon)$$

The shock in the upturn is $+\varepsilon$. Note that the literature shows that a government in a developed economy usually runs counter-cyclical policy in recessions; thus, the government will prefer performing a counter-cyclical policy also in expansions, to allow for a surplus that will finance a counter-cyclical policy in the downturn. Thus, government will reduce, alternatively, tax expenditures or government spending by $\Delta g$ or $\Delta e$ respectively:

$$\Delta pd_1 = -\Delta g_1 - \varepsilon\tau$$

$$\Delta pd_1 = -\Delta e_1 - \varepsilon\tau$$

Let us look at interest payments when the adjustment is done through g:

$$\Delta r_1 = r * (-\Delta g - \varepsilon\tau) < 0$$

$$\Delta d_1 = -\Delta g - \varepsilon\tau + \Delta r_1 = (-\Delta g - \varepsilon\tau) * (1 + r) < 0$$

During the upturn government debt as percent of GDP is significantly reduced through all elements of fiscal policy.

By the end of period 1, the positive phase of the cycle is replaced by a negative shock of equal magnitude, i.e. ε, in period 2. The total deficit in period 2 is conditional, again,

on the policy instrument used by the government. When government spending is raised countercyclically, the deficit is:

$$d_2 = g + \Delta g + e - \tau Y_2 + \varepsilon\tau + \Delta r_1$$

And when compared to the initial deficit the deficit change is:

$$\Delta d_2 = \Delta g + \varepsilon\tau + \Delta r_1 > 0$$

Under tax expenditures it is:

$$d_2 = g + e + \Delta e - \tau Y_2 + \varepsilon\tau + \Delta r_1$$

and when compared to the initial deficit the deficit change in the case of adjustment through g is:

$$\Delta d_2 = \Delta e + \varepsilon\tau + \Delta r_1 = (\Delta g + \varepsilon\tau) * (1 + r) > 0$$

If fiscal policy is symmetric to the upturn, $|\Delta e| = |\Delta g| = \varepsilon\tau$; also, $\Delta r_1 > 0$. Note that because of the symmetry of the shock, the deficit reduction in the upturn finances exactly the deficit increase in the downturn.

Thus, in a developed economy two facts are driven from the model: i) fiscal policy is symmetric: counter-cyclical (decreased expenditure) in an upturn and counter-cyclical in the downturn (increased expenditure); ii) fiscal policy can be im[plemented through government expenditure or tax expenditure, with no preference for one tool over the other. The lack of difference is based in the fact that actual and reported deficit are considered by policymakers as tools that at the end of the day affect debt – and consequently they are treated symmetrically.

**D.2 Developing Economies**

Developing economies are highly influenced by rating agencies reports, which differ remarkedly relatively to developed economies. When signs of fiscal imbalance appear in real time, rating agencies claim immediate deficit reduction—even during downturns—making their recommendations inherently procyclical.[8] Because of the

[8] See Presbitero, Ghura, Adedeji & Njie (2015) and Eichengreen, Hausman and Panizza (2002). These papers are part of the issue known as "Original Sin", which explores the reason for emerging and developing countries' difficulty for expanding debt.

constraints related to debt emission (that are influenced by rating agencies), and unlike the situation in developed economies, economic upturns offer developing countries governments an opportunity to expand government or tax expenditures, an option that is often politically advantageous (see politically motivated policy as explained by Talvi and Vegh, 2005). Policymakers are acutely aware that such fiscal expansion is typically unfeasible during economic downturns, which are generally associated with rising public debt. This behavior provides an incentive for governments to adjust their response given the advantage related to the reported deficit.[9]

Under government expenditure expansion, the reported deficit during the expansion period is given by:

$$d_1^R = g_1 + \Delta g + e_1 - \tau(Y_1 + \varepsilon) + r * debt_1$$

$$\Delta p d_1^R = \Delta g - \varepsilon\tau = 0$$

$$\Delta r_1 = r * (\Delta g - \varepsilon\tau) = 0$$

i.e., if the government allocates the entirety of additional tax revenues to expenditure, both the deficit-to-GDP ratio and the debt-to-GDP ratio are expected to remain stable. If, alternatively, the expansionary fiscal policy is implemented through tax expenditures ($\Delta e$), the reported actual deficit is[10]:

$$d_1^R = g_1 + e_1 - \tau(Y_1 + \varepsilon) + r * debt_1$$

$$\Delta p d_1^R = -\varepsilon\tau < 0$$

$$\Delta r_1 = r * (\Delta e - \varepsilon\tau) = 0$$

i.e., in contrast to an increase in government expenditure, in this case there is a difference between reported and actual deficit; that's not the case for the interest payments, since the expansionary fiscal policy is financed by debt. Note that concerning interest payments, if the government spends all additional resources, we obtain that $\Delta r_1 = 0$. Thus, in the downturn the increase in the reported deficit for the case of pro-cyclical policy in the developing country under government expenditure is:

[9] Ardanaz et al. (2023) show that many voters that are uninformed (as opposed to informed and risk averse voters) support such policy.

[10] The use of tax expenditures must be financed. Thus, although the additional tax expenditure is not reported, but it affects the debt (and consequently also interest payments).

$$\Delta d_1^R = \Delta g - \varepsilon\tau + \Delta r_1 = 0$$

While under tax expenditures it is:

$$\Delta d_1^R = -\varepsilon\tau + \Delta r_1 < 0$$

i.e., in the developing country's case the difference occurs only in reported deficit as percent of GDP during the expansion: when the utilized tool is government spending, the reported deficit remains constant; if the utilized tool is tax expenditures, the reported deficit goes down by the increase in tax revenues (following the increase in GDP). In other words, for the developing country's government, the use of tax expenditures is more appealing, because it implies a lower reported deficit in real time.

Assume now that during the year the economy suddenly suffers from a downturn, while government expenditure (or tax expenditure) remains at the new higher level. Assume that debt negotiation with the IMF occurs at the beginning of the downturn. In that case, the maximal required stabilization cut is, respectively[11]:

$$\Delta d_2^g = \Delta g + \varepsilon\tau + \Delta r_1 > \Delta d_2^e = \varepsilon\tau + \Delta r_1$$

In other words, since interest payments remain constant, the magnitude of the required reductions in government spending is twice that observed under the tax expenditure scenario.

Marginal utility of the negotiated cut with rating agencies in a recession is:

$$\left|u'(\Delta d_2^g)\right| > |u'(\Delta d_2^e)|$$

Since the required adjustment involves a reduction in expenditure, a higher marginal utility implies that the cut imposes a greater burden. Two key conclusions emerge from the analysis of developing countries: (i) these countries are likely to pursue procyclical policies during upturns via tax expenditures; and (ii) during downturns, when rising

[11] If the developing economy does not function as a democracy the information about the amount of the tax expenditure is difficult to obtain. If the developing country functions as a parliamentary democracy, then the tax expenditure would be based on a law approved in the parliament. In this case clearly the international agency can gather the information. However, given the difficult circumstances (recession) in which the negotiations are taking place, the unreported tax expenditure may be purposedly overlooked by both the developing economy and the international agency, to avoid forcing a painful adjustment in the short-run.

debt becomes apparent, governments are compelled to implement procyclical expenditure cuts.

In summary, for developing countries, we anticipate a pattern of procyclical tax expenditure policies during economic upturns, accompanied by procyclical expenditure cuts of comparable magnitude during recessions.

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