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Public Investment, Government Consumption, and Growth: A Long-run Analysis

Macroeconomics, Trade, and Investment

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Abstract

High debt and limited fiscal space demand fiscal consolidation. However, cutting spending should not compromise long-term growth. Public investment should be protected, avoiding wasteful projects. Cuts in public consumption must be cautious to maintain the quality of infrastructure and of service delivery. Analyzing data from 112 countries (1960-2019), we find that both public investment and consumption boost long-term output. In low- and high-income countries we find investment has a stronger impact. Notably, increasing or decreasing public investment significantly affects GDP, whereas cutting government consumption does not harm long-term output. Fiscal policies should thus prioritize preserving investment over consumption, targeting non-productive consumption for reductions. Compensation of employees does not significantly impact growth and can be considered for consolidation. Diverse economic conditions across countries suggest tailored fiscal strategies rather than a universal approach.

JEL Classification: C33, C54, O47, E62

Keywords: Public investment and consumption; Fiscal Policy; Long-run; Growth; heterogeneous panel; asymmetric impact; cross-sectional dependence

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1 Introduction

In a global economy characterized by multiple and large shocks, governments across the world have had to harness all possible policy options to stabilize their economies and safeguard long-term development. Specifically, on the one hand, governments are under pressure to scale up public expenditures to alleviate high levels of poverty and meet large global infrastructure needs. On the other hand, several countries are facing imminent fiscal consolidation in response to rising debt-to-GDP ratios. Policymakers, therefore, face a dual policy challenge where they need to simultaneously spend to foster long-run growth while also ensuring debt sustainability. To this end, a timely and comprehensive cross-country analysis that examines the long-run impact of government expenditures on output can help inform decision-making on policy strategies and reforms to achieve this dual policy objective.

This paper provides new evidence on the long-run impact of public investment and consumption on real GDP from a large panel of 112 developed and developing countries over the period 1960-2019. We estimate long-run government multipliers using recently developed heterogeneous panel estimators by Chudik, Mohaddes, Pesaran, and Raissi (2017). Hence, we allow for a variation of the long-term impact of public investment and government consumption on growth across countries and income levels. We document the following results: First, we find that, on average, public investment and consumption both have a positive and statistically significant long-run impact on output. Moreover, in our baseline results, the long-run impact of public investment on output is larger in magnitude than a similar sized increase in public consumption in low- and high-income countries. Second, we find that, on average, public investment and consumption both have a positive and statistically significant impact on output in the short run, although the impact of government consumption is larger. Third, the results from the asymmetric analysis show that, across all income groups, an increase (decrease) in public investment leads to a rise (fall) in GDP in the long run. Moreover, except for lower-middle-income countries, the results reveal that cuts in public investment tend to have a more pronounced negative impact on output in the long run. In contrast, we find evidence that while an increase in government consumption is positively associated with output, the impact of cuts in government consumption on output is not statistically different from zero in the long run.

From a policy perspective, our findings suggest that fiscal consolidation packages that cut public investment rather than government consumption will hurt log run growth. In contrast, fiscal adjustments that preserve public investment but cut public consumption will have little to no adverse long-run effects on GDP. However, given that government consumption comprises important components like goods, services, and regular maintenance, policymakers should be cautious when cutting the former—i.e., cuts should target non-useful and non-productive consumption. Indeed, we find that within the government consumption, the non-compensation component is the one driving the long run positive impact on growth.

There is a rich and extensive literature that examines the relationship between output and the components of government expenditure. Older studies such as Barro (1990) analyzed developed economies and found positive long-term impact of productive public spending on growth, and negative impact of non-productive public spending. Barro defines productive public spending as the sum of physical capital spending, education and training spending, part of health related to childbearing (to build human capital), and law maintenance and national security (to guarantee property rights). Thus, productive public spending for Barro is a combination of public investment components and public consumption components. Devarajan et al. (1996) analyze 43 developing countries and find that the share of primary current expenditures (public consumption plus transfers and subsidies) contributes positively to growth compared to the capital component of public expenditures that has a negative impact. Part of the explanation for this finding, as argued by the authors, is that current expenditure components such as operational and maintenance spending may have a higher rate of return than public investment.

Findings from the literature post-Barro and Devarajan are generally mixed. For example, studies such as Gupta et al. (2005) who focused on 39 low-income countries and assessed the effects of fiscal consolidation and expenditure composition on economic growth found that spending on wages yields lower growth than capital and nonwage goods and services. They also found that strong budgetary positions are generally associated with higher short- and long-term growth. Ghosh and Gregoriou (2008) found that operations and maintenance spending have stronger impact on growth than both health and education. Kneller et al. (1999), after correcting for the biases associated with the incomplete specification of the government budget constraint, found that productive government expenditure enhances growth, whilst non-productive expenditure does not.

Recent studies like Francois and Keinsley (2019) examined the long-term effect of public consumption and public investment on output for 33 low- and lower-middle-income developing countries. The authors found that on average, government consumption had a negative association with output in the long run. Calderon et al. (2015) focused on estimating the elasticity of output with respect to public infrastructure. The authors found positive elasticities but at varying sizes, sometimes as small as 0.05 to as large as 0.5. Espinoza et al. (2019) found that increasing public investment by 1% of GDP raised output, private investment, and employment by 2.7% after 2 years. Focusing on multipliers, like we do in this paper, Boehm (2020) found evidence that while government consumption raises output, the multiplier associated with public investment is near zero in OECD countries. Geli and Moura (2023), investigate 177 countries over the period 1997 – 2019. They find average cumulative medium-term multipliers of 0.3 for investment and -0.5 for consumption for advanced economies against 1.7 for investment and 1.9 for consumption for emerging markets.

Our paper contributes to the existing literature by providing new, systematic, and robust evidence of the long-run impact of public investment and consumption for a large panel of developed and developing countries in a heterogenous panel setting.[2] Most existing studies assume slope homogeneity, where government spending affects growth the same way in all countries. However, diverse country characteristics including differences in the exchange rate regime (Ilzetzki, Mendoza and Végh, 2013), on the quality of the institutions (Honda, Miyamoto and Taniguchi, 2020), the degree of informality (Colombo et al., 2022), different output elasticity of public capital … strongly suggest that the long-run relationship in question may vary across countries. It is, therefore, not surprising that the existing literature, using different samples (across countries and periods) finds mixed results. The mixed results may be attributed to these unaccounted heterogeneities across countries. These potential different country characteristics motivate the need for a framework that allows for heterogeneity in the relationship between government expenditure components and economic growth across countries; a feature discounted in the current literature (see, for example, Agénor and Neanidis, 2011; Bose et al., 2007; Devarajan et al., 1996; Ghosh and Gregoriou, 2008; Gupta et al., 2005; Ormaechea and Morozumi, 2013). Additionally, allowing for the asymmetric impact of increases or decreases in public investment and consumption on output in this study provides new and timely policy insights into fiscal consolidation strategies.

The rest of the paper is organized as follows: Section 2 describes our empirical strategy and briefly discusses the data. Section 3 presents and discusses the main results. Section 4 presents the findings from the asymmetrical impacts of public investment and government consumption on output as well as the impact of subcomponents of public consumption, and the implication for fiscal consolidation. Section 5 concludes and discusses policy implications.

2 Empirical strategy: the estimation of long-run effects

In this section, we outline how we estimate the long-run relationship between growth and public investment and consumption. We start with the description of the estimation using recent dynamic panel estimators

[2] We follow the economic classification of public spending along the lines of the System of National Accounts, SNA-2008 and Government Finance Statistics, GFSM-2014 and we consider public consumption and public investment as defined by these frameworks. This allows us to directly relate our results to the policy frameworks used by decision makers in the Ministries of Finance, Budget, and Economy.

proposed by Chudik et al. (2017, 2013). To explore the importance of slope heterogeneities, simultaneous determination of the public expenditure variables and growth, and dynamics, we follow Chudik et al. (2017, 2013) and employ autoregressive distributed lag (ARDL) specification, which is given as follows:

$$\Delta y_{it} = \sum_{l=1}^{p_y} \varphi_{il} \Delta y_{i,t-l} + \sum_{l=1}^{p_x} \beta_{il}' \Delta \mathbf{x}_{i,t-l} + u_{it}, \quad (2.1)$$

$$u_{it} = \lambda_i' \mathbf{f}_t + \varepsilon_{it}, \quad (2.2)$$

where $i = 1, 2, \ldots, N$ is country i in the panel and $t = 1, 2, \ldots, T$ represent the time period. To capture the multiplier impact, we follow Owang, Ramey, and Zubairy (2013) and Kraay (2014) amongst others and define the variables in the regression as follows: For the dependent variable, we define $\Delta y_{it} = \frac{Y_{it} - Y_{it-1}}{Y_{it-1}}$, where Y_{it} is GDP. The vector $\mathbf{x}_{it}$ is the vector of country-specific regressors of interest, which in our case comprises two variables— public investment and government consumption. The variables are defined as first-difference of the of government consumption and public investment normalized by lagged GDP (i.e., $\Delta x_{it} = \frac{x_{it} - x_{it-1}}{Y_{it-1}}$). This specification allows us to interpret the coefficients as multipliers. The term $\mathbf{f}_t$ is a vector of unobserved common factors or shocks with factor loadings λ_i', and ε_{it} are individual-specific idiosyncratic errors that are uncorrelated with the factors. It is worth mentioning that total factor productivity (TFP) in the empirical specification, is modelled as part of the unobserved common factors with country-specific "factor loadings" in Equation (2.2). As in Eberhardt and Presbitero (2015), $\mathbf{f}_t$ accounts for the levels and evolution of unobserved TFP. Importantly, Chudik et al (2011) and Eberhardt and Presbitero (2015) discuss that the unobserved common factor controls for omitted variables and large sets of latent drivers of output. Consequently, while not explicitly modelled, TFP and other omitted variables are conveniently embedded in the empirical framework in the manner of the aforementioned studies. Finally, $\mathbf{f}_t$ can be serially correlated, and can also be correlated with the regressors in the study.

There are a number of important and desirable features of the specification in Eq. (2.1): First, as shown by Chudik et al. (2017, 2013), Eq. (2.1) explicitly allows for feedback mechanisms, where the dependent variable and regressors are jointly determined by a vector autoregressive model. The equation therefore permits for feedback effects from GDP growth to the regressors, which in our case is particularly important and raises endogeneity issues. Specifically, government spending components tend to respond to lagged output gap to capture systematic feedback from output (see, Zubairy, 2014, for example). Thus, accounting for them is highly relevant in our case, and the ARDL specification is robust to such feedbacks. Second, in the same framework, Chudik et al. (2017, 2013) assume a linear dependence between the contemporaneous error terms in bivariate VAR(1) to address potential simultaneous bias. With this assumption, the authors are able to identify the key parameters of their model and hence, the long-term effects as the error term u_{it}, by construction, would not be correlated to the regressor.[3] Third, the ARDL specification in Eq. (2.1) also allows for slope heterogeneity, which when not explicitly modelled can induce inconsistent estimates and hence, inference.

Let us now denote the long-run coefficient vector as θ_i. From Eq.(2.1), Chudik et al. (2016, 2013) show that the long-run coefficients are given by

$$\hat{\theta}_i = \frac{\sum_{l=0}^{p_x} \beta_{il}}{1 - \sum_{l=0}^{p_y} \varphi_{il}} \quad (2.3)$$

and in the case of the whole panel (or multi-country case), the average long-run coefficient vector is given by the mean-group (MG) value,

$$\bar{\theta}_{MG} = 1/N \sum_{i=1}^{N} \theta_i \quad (2.4)$$

[3] Chudik et al. (2017, 2013) point out that the problem of estimation and inference in the case of multiple long-term relations is further complicated by the identification problem and simultaneous determination of variables. The case of multiple long-term relations is discussed for example in Pesaran (1997).

where *N* is the number of countries in our panel. To estimate the long-run coefficients and hence, the mean group estimator in Eq. (2.4), the practitioner can employ the ARDL approach by estimating the individual short-run coefficient in Eq. (2.1) in the ARDL relation, and then compute the estimates of the long-run effects as in Eq. (2.4). Nonetheless, because our primary goal is to uncover long-run effect, we also employ the distributed lag (DL) approach proposed by Chudik et al. (2016, 2013). The DL approach estimates θ_i directly based on transforming the ARDL model in Eq. (2.1). Consequently, we consider DL approach for estimating the long-run effects, which in our case is given as[4]

$$\Delta y_{it} = c_i + \theta_{il}'\Delta x_{it} + \sum_{l=1}^{p_x} \alpha_{il}' \Delta^2 x_{i,t-l} + u_{it} \quad (2.5)$$

Until now, we have been silent on the presence of cross-sectional dependence. Recall that we allowed a multi-factor error structure in Eq. (2.2) to capture cross-sectional dependence arising from global shocks and economic spillovers. When not explicitly modelled and dealt with it, the latter can generate inconsistent coefficient estimates and severely impact inference (Chudik et al., 2017; Eberhardt and Presbitero, 2015; Francois et al., 2022). While there are a number of ways to deal with this error cross-sectional dependence (see, Chudik et al., 2017, for a discussion), we follow Chudik and Pesaran (2015a), by augmenting Eq. (2.5) with the set of cross-section averages of output growth and all the right-hand variables in Eq. (2.5) and their lags to obtain the "CS-DL" specification.

$$\Delta y_{it} = \theta_{il}'\Delta x_{it} + \sum_{l=0}^{p_x-1} \alpha_{il}\Delta^2 x_{i,t-l} + \psi_{iy}\Delta\bar{y}_t + \sum_{l=1}^{p_x} \psi_{i,xl}\,\Delta\bar{x}_{t-l} + \tilde{v}_{it} \quad (2.6)$$

Similarly, the ARDL model in Eq. (2.1) can be augmented with cross-section averages of output growth, all the right-hand variables in Eq. (2.1) and their lags, to obtain the "CS-ARDL" specification

$$\Delta y_{it} = \sum_{l=1}^{p_y} \varphi_{il}\,\Delta y_{i,t-l} + \sum_{l=0}^{p_x} \beta_{il}'\Delta \mathrm{x}_{i,t-l} + \sum_{l=1}^{p_{\bar{y}}} \omega_{y,il}\,\Delta\bar{y}_{t-l} + \sum_{l=0}^{p_{\bar{x}}} \omega_{x,il}'\,\Delta\bar{\mathrm{x}}_{t-l} + \tilde{u}_{it} \quad (2.7)$$

In our baseline estimation of the long-term impact of public expenditures on growth, we select the CS-ARDL specification in Eq. (2.7). We also report estimates from the CS-DL. Specifically, CS- DL estimator has some advantages that complements the CS-ARDL as follows: First, the time dimension on our data is relatively moderate (i.e., the minimum time series is set to 25 in our sample, which is less than 100), and as discussed by Chudik et al. (2016, 2013) the sampling uncertainty in the ARDL model could be large when the time dimension is moderate (T < 100). The CS-DL estimator is robust to small-sample time series properties. Second, the performance of the ARDL estimator also depends on a correct specification of the lag orders of the underlying ARDL specifications. Underestimating the lag orders leads to inconsistent estimates, while overestimating the lag orders could result in loss of efficiency and low power when the ARDL long-run estimates are used for inference. The DL on the other hand do not have these constraints. Furthermore, the CS-DL approach is robust to a number of departures from the baseline specification, such as residual serial correlation, and possible breaks in the error processes. However, unlike the ARDL, the DL estimator does not allow for feedback effects from the dependent variable onto the regressor. Furthermore, the small sample performance of the DL deteriorates when the roots of the AR polynomial in the ARDL representation are close to the unit circle.[5] Given that we are primarily concerned about uncovering the long-term growth impact of public expenditure and the features of our data (e.g., small time series), we also present results from the CS-DL estimator to show that both the latter and the CS-ARDL produce very similar long-run estimates. We then proceed to use the CS-DL estimator for the rest of the analysis in the paper to focus on long run relationships.

2.1 Data. We utilize data from the IMFs Investment and Capital Stock Dataset, 1960-2019 (May 2021 version) and World Bank's World Development Indicators (WDI). The investment variable – public investment — is obtained from the IMF Investment and Capital Stock Dataset. The dependent variables real GDP and the government consumption variable are retrieved from the WDI. Following Kraay (2014), all the variables are

[4] For the technical details see, Chudik et al. (2016, 2013). Recent applications of the DL estimator include Chudik et al. (2017).
[5] The relative merits of the ARDL and DL estimator are succinctly discussed in Chudik et al. (2016, 2013).

measured in local currency units. For expositional purposes, the summary statistics for the variables employed in the empirical analysis are reported in Table B.1 in Annex B.

Our unbalanced panel comprises 112 developing and developed countries with annual data covering 1960 – 2019. Using the World Bank's income classification framework (as of July 2022), the data comprises 40 high-income countries and high-income economies (HICs/HIEs), 25 upper-middle income countries (UMICs), 31 lower-middle income countries (LMICs), 13 low-income countries (LICs). The complete list of countries in the sample employed in the estimation is presented in Table B.1 in Annex B. The long-term dynamic panel estimators we employ are designed for moderate to large time dimension (T) and number of countries (N); hence, we include countries for which data exists for at least 25 consecutive annual observations on each of the variables involved in the empirical estimation. Chudik et al. (2013) conduct Monte Carlo exercise and presents results for the case of moderate T = 30, which is often desirable in the estimation of long-run effect. In fact, by increasing T to 30, whatever additional accuracy that might be obtained is eliminated due to the loss of about 17% of the cross-sectional units. Using the cut off T = 25 helps cover a large spectrum of countries (i.e., 112) and draw general conclusions on the key long-term relationships in question. Indeed, several recent published papers utilizing these long-term estimators employ panels with T less than 30 but greater than 20 (see, Anderson and Raissi, 2022; Anderson et al., 2018; Fall and Fournier, 2015; Francois et al., 2022; Mohaddes et al., 2017; Mohaddes and Raissi, 2014).

3 Results

In this section, we report the results from the CS-ARDL and CS-DL specification in Table 1 and 2, respectively. We report results from the full sample, which comprises 112 countries and results from income groups using the World Bank's income group classification as of 2023.

3.1 Baseline estimates based on CS-ARDL approach.

Table 1 reports the estimated average short- and long- run impact based on the CS-ADL approach. The long-run impact of public investment and consumption on GDP is reported in Panel B in Table 1. We find evidence that the associated impact of public investment on GDP in the long run is consistently larger than the impact of government consumption in HICs/HIEs and LICs. More precisely, in the full sample we find that, on average, a dollar increase in public investment and consumption is associated to a 1.13- and 0.88-dollar respective increase in output in the long-run. Importantly, we find strong evidence that a dollar increase in public investment is associated to about 1.54, 0.99, and 1.52 dollar increase in output in the HICs/HIEs, UMICs, and LICs, respectively. Meanwhile, there is no long-run association between government consumption and output in HICs/HIEs, UMICs, and LICs. In the context of LMICs, we find that both public investment and consumption have a positive long-run association with output, although the impact of public investment on output is relatively larger. That is, a dollar increase in public investment and consumption is associated with 0.82 and 0.65 dollar increase in output, respectively. The results from the income groups highlights the important heterogeneity of the impact of government expenditures on output, that is hidden in the results from the full sample.

For the short run, we find that on average a 1 dollar increase in public investment and government consumption is associated with 0.73 and 0.95 dollar increase GDP, respectively, for the full sample (Column 1, Panel A: Table 1). When we turn to the income groups, we find some heterogeneity in the results. Specifically, we observe that a one dollar increase in public investment increases output by 0.96, 0.77, 0.45, and 0.65 dollars in HICs/HIEs, UMICs, LMICs, and LICs, respectively. We also find evidence that the short-run impact of public investment is larger than the ones related to government consumption for HICs/HIEs (0.62) and LICs (0.17), where the impact is statistically insignificant. In contrast, the short-run multiplier for public investment is relatively smaller than the government consumption multipliers in UMICs (1.17) and LMICs (0.93). It is worth mentioning that the findings for UMICs and LMICs are in line with Geli and Moura (2023), who find evidence of larger government consumption multipliers in emerging economies (i.e., 1.9) relative to 1.7 for government investment.

Table 1: Short- and Long-term Impact of Public Expenditures on Growth from CS-ARDL Approach

	(1) Full sample	(2) HIC/HIE	(3) UMIC	(4) LMIC	(5) LIC
		Panel A: Estimated Short-run relationship			
Lagged GDP growth	0.163***	0.247***	0.246***	0.171***	0.0190
	(0.0242)	(0.0344)	(0.0608)	(0.0490)	(0.0958)
Public Investment	0.728***	0.963***	0.768***	0.454***	0.654***
	(0.0798)	(0.163)	(0.187)	(0.0970)	(0.183)
Government consumption	0.950***	0.617***	1.173***	0.928***	0.174
	(0.132)	(0.182)	(0.340)	(0.198)	(0.216)
		Panel B: Estimated Long-run relationship			
Public Investment	1.125***	1.536***	0.990**	0.824***	1.519***
	(0.183)	(0.421)	(0.500)	(0.233)	(0.272)
Government consumption	0.875***	-0.359	0.400	0.646*	-0.0691
	(0.232)	(0.456)	(1.298)	(0.345)	(0.350)
Speed of adjustment	-0.837***	-0.753***	-0.754***	-0.829***	-0.981***
	(0.0242)	(0.0344)	(0.0608)	(0.0490)	(0.0958)
No. of observations	4229	1576	929	1254	472
No. of countries	112	42	25	31	13
CD p-value	0.458	0.114	0.000771	0.107	0.433
R-squared	0.562	0.603	0.477	0.587	0.555

Notes: The dependent variable is the change in log of GDP measure in constant local currency. ***, **, and * indicate significance at the 1, 5, and 10 percent level. P-values in parenthesis. The estimation is the cross-section augmented AR distributed lag (CS-ARDL) by Chudik et al. (2013, 2017). The estimator controls for parameter heterogeneity across countries and cross-sectional dependence arising from global shocks and economic spillovers. The specific regression model is given in Eq. (2.7). The ARDL(py, px, pz), where py, px, and pz represent the lags on the dependent variable. Given potential small sample biases with the data in developing countries, we correct for the latter using the recursive correction in the full sample and all income groups except HICs/HIEs; where results do not change when we control for small sample bias.

3.2 Direct long-run estimates based on CS-DL approach. Table 2 reports the results from the CS-DL estimator, which computes the direct long-run relationship in question. The estimated long-run relationship in the table generally supports the findings in Table 1. In particular, we find that, at the income group level, the associated long-run increase in output following an increase in public investment is consistently larger than that of government consumption except for the case of UMICs. Moreover, we observe that the associated increase in output following a dollar increase in public investment ranges from around 0.93 dollar in LMICs to approximately 1.67 dollars in HICs/HIEs. It is worth mentioning that the size of the public investment multiplier in LICs in Table 2 is comparable to the one estimated in Eden and Kraay (2014), who find a public investment multiplier of 1.5. In contrast, we find no long-run association between government consumption and output in HICs/HIEs and LICs.[6]

[6] Our results for high-income countries in Tables 1-2 contradicts recent studies (i.e., Boehm 2020) that find larger government consumption multiplier compared to public investment multipliers in OECD countries of which several are HICs/HIEs.

However, we find that a dollar increase government consumption is associated to 0.82 and 1.49 dollar increase output in LMICs and UMICs, respectively.

Table 2: Direct Long-run Effect of Public Expenditures on Growth from CS-DL Approach

	(1) Full sample	(2) HIC	(3) UMIC	(4) LMIC	(5) LIC
Public Investment	1.156***	1.666***	1.086**	0.927***	1.319***
	(0.171)	(0.362)	(0.483)	(0.186)	(0.261)
Government consumption	1.129***	0.109	1.499***	0.817***	0.403
	(0.187)	(0.333)	(0.500)	(0.277)	(0.355)
No. of observations	4343	1576	929	1285	486
No. of countries	112	42	25	31	13
CD p-value	0.342	0.0596	0.224	0.0833	0.115
R-squared	0.604	0.689	0.446	0.661	0.601

Notes: The dependent variable is the change in log of GDP measure in constant local currency. ***, **, and * indicate significance at the 1, 5, and 10 percent level. P-values in parenthesis. The estimation is the cross-section augmented distributed lag (CS-DL) by Chudik et al. (2013, 2017). The estimator controls for parameter heterogeneity across countries and cross-sectional dependence arising from global shocks and economic spillovers. The specific regression model is given as in Eq. (2.6).

4 Asymmetric Effect on growth, analysis of the subcomponents of public consumption and implication for fiscal consolidation

With the objective of informing fiscal consolidation policies in mind, we investigate whether the long-term growth impacts of public consumption and public investment are symmetric. Also, keeping in mind the results of Ghosh and Gregoriou (2008) and Gupta et al. (2005) on the contribution to growth of nonwage goods and services, as well as the intuition of Devarajan et al. (1996) on the matter, we examine the growth impact of compensation and non-compensation components of public consumption.

4.1 Asymmetric long-term effects.

In this section, we investigate the potential asymmetry in the long-term relationship between the two expenditure components and output. Specifically, we examine whether the long-run impact of an increase versus decrease in public investment or government consumption on output differ in magnitude and sign. As discussed in Lu and Zhu (2021), expansionary and contractionary government spending have asymmetric effects, with increases in government spending having a significantly greater impact on output and employment. This could be attributed to the state-dependent nature of government spending multipliers, which vary based on factors such as the overall debt level (Ilzetzki et al., 2013), business cycles (Ramey and Zubairy, 2018), and the stance of monetary policy (Amendola et al., 2020). Notice that an asymmetric long run analysis can help us gain some insights into the long-run consequences of fiscal consolidation choices on output. For our analysis, we decompose the changes in government investment and consumption into positive and negative components as in 2012) and Choi and Kim (2010). Specifically, we define government expenditure variable *X* as

$$X_{it}^{+} = X_{it} - X_{it-1}, \text{if } (X_{it} - X_{it-1}) > 0, \text{otherwise } 0, \tag{3.1}$$

$$X_{it}^{-} = -(X_{it} - X_{it-1}), \text{if } (X_{it} - X_{it-1}) < 0, \text{otherwise } 0, \tag{3.2}$$

Notice that both variables are never negative. However, Eq. (3.1) and (3.2) represent an increase and decrease, respectively. Using the baseline specification and variable definitions, we re-estimate the model with the positive and negative changes in the expenditure variables as regressors. With the focus primarily on long-run analysis, and to reduce model misspecification, we employ the CS-DL for this exercise.

Table 3: Asymmetric Long-run Effects of Public Expenditures

	(1) Full Sample	(2) High Income	(3) UMIC	(4) LMIC	(5) LIC
Public investment $^{(+)}$, α_1^+	0.776**	1.115**	0.665**	0.778**	0.866**
	(0.379)	(0.516)	(0.263)	(0.306)	(0.345)
Public investment $^{(+)}$, α_1^-	-1.835***	-1.623**	-1.251*	-0.625*	-2.706***
	(0.487)	(0.647)	(0.696)	(0.367)	(0.942)
Government consumption $^{(+)}$, α_2^+	0.711**	0.304	1.816***	0.739**	0.502
	(0.302)	(0.380)	(0.327)	(0.299)	(0.383)
Government consumption $^{(-)}$, α_2^-	1.344	-0.716	-1.070	-0.593	1.470
	(1.351)	(1.923)	(2.862)	(1.215)	(1.109)
No. of observations	4229	1620	979	1316	472
No. of countries	112	42	25	31	13
CD p-values	0.00122	0.788	0.00307	0.685	0.0108
R-squared	0.449	0.607	0.465	0.634	0.391

Notes: The dependent variable is the change in log of GDP measure in constant local currency. ***,**, and * indicate significance at the 1, 5, and 10 percent level. P-values in parenthesis. The estimation is the cross-section augmented distributed lag (CS-DL) by Chudik et al. (2013, 2017). The estimator controls for parameter heterogeneity across countries and cross-sectional dependence arising from global shocks.

Table 3 presents the results. We find consistent evidence that an increase (decrease) in public investment is positively (negatively) associated with an increase in output for the full sample and across all income groups. Moreover, except for LMICs (column 4, Table 3), we observe that decreases in public investment have a larger negative impact on output in the long run. Turning to government consumption, we find evidence that while an increase in government consumption is positively associated to output in the long run, long-run impact of decreases on government consumption on output is not statistically different from zero. These results generally suggest fiscal consolidation packages that cut public investment rather than government consumption will hurt growth. In contrast, consolidation packages that preserve public investment but cut public consumption will have little to no adverse long-run effects on GDP.[7]

4.2 Compensation component versus non-compensation components of public consumption. While the asymmetric analysis suggests that increase in government consumption has positive impact on growth during fiscal expansion and no significant impact on growth if decreased during consolidation, it becomes important to understand the behavior of public consumption subcomponents. Government consumption comprises compensation to government employees and other components including consumption of goods and services, and regular maintenance spending. Compensation to employees comprises a significant portion of government consumption, and it is important to investigate whether the non-compensation component of government consumption does matter for long-term growth. We disaggregate government consumption into two subcomponents—i.e., a compensation to employees and non-compensation component. We then re-

[7] Similar evidence is found in Francois and Keinsley (2019)

estimate our baseline model specification in Eq. (2.6) with the two subcomponents as explanatory variables.

Table 4: Long-run Fiscal Multipliers of compensation and non-compensation component of public consumption

	(1) Full Sample	(2) High Income	(3) UMIC	(4) LMIC & LIC
Public investment	1.246***	1.170***	1.399***	1.130***
	(0.221)	(0.300)	(0.495)	(0.284)
Other Government consumption	1.138***	0.923***	1.396***	0.688
	(0.330)	(0.344)	(0.709)	(0.628)
Compensation of employees	0.799*	-0.290	1.571*	0.921
	(0.443)	(0.861)	(0.805)	(1.135)
No. of observations ($N \times T$)	2,417	1,270	569	578
Number of countries	86	39	22	25
CD test (p-value)	0.705	0.839	0.780	0.819

Notes: The dependent variable is the change in log of GDP measure in constant local currency. ***,**, and * indicate significance at the 1, 5, and 10 percent level. P-values in parenthesis. The estimation is the cross-section augmented distributed lag (CS-DL) specification by Chudik et al. (2013, 2017). The estimator controls for parameter heterogeneity across countries and cross-sectional dependence arising from global shocks. For this estimation, we use the xtmg command in STATA by Eberhardt and Teal (2012) for the estimation. The xtmg command does not report the R-squared as part of post-estimation statistics.

Table 4 shows the long-run multipliers of the compensation of employees' component of public consumption, the non-compensation component, and public investment. The public investment multipliers are all positive, significant and vary between 1.1 and 1.4, which is constituent with the results of Tables 1-2 and with the literature. Interestingly, the multipliers of the non-compensation component of public spending are of the same magnitude of the investment multipliers, ranging from 0.7 to 1.4. They are all positive, although the LMIC&LIC multiplier is non-significant. The compensation multipliers are below 1, except for UMICs, non-significant, except for the multipliers of the Full Sample and of UMICs that are significant at 10%, and positive, except for the multiplier for HICs/HIEs that is negative. These results confirm the importance of spending on goods, services, and regular maintenance for Long-run growth and the need to deal with them granularly and as carefully as with public investment.

5 Concluding Remarks

Global events starting with the COVID-19 pandemic in 2020 and followed by geopolitical turmoil are slowing down and reversing development trends. Specifically, rising debt-to-GDP ratios, increasing global interest rates, volatile energy and commodity prices, and domestic macroeconomic challenges have made achieving development goals difficult (World Bank, 2022). For policymakers, effectively utilizing public expenditures as a policy tool to ensure long-term growth while maintaining a stable debt environment is crucial.

Using a large panel of 112 developed and developing countries over the period 1960-2019 and we employ recently developed heterogeneous panel techniques, the following key results emerge: On average public investment and government consumption both have positive and statistically significant long-run impact on output. However, the associated long-run impact of public investment on output is larger in size than the case of government consumption in all income groups except for upper-middle income countries. Furthermore, results from the asymmetric analysis uncover that, across all income groups, an increase (decrease) in public

investment leads to a rise (fall) in GDP in the long run. On the other hand, we find evidence that while an increase in government consumption is positively associated to output, cuts in government consumption has no impact on output in the long run. Nonetheless, the heterogeneity results caution against a one-size-fits-all approach to fiscal policy design.

From a policy perspective, this suggests that, on average, the results suggest that while fiscal consolidation packages that cut public investment rather than government consumption will hurt growth, consolidation packages that preserve public investment but cut public consumption will have little to no adverse long-run impact on GDP. However, it is important to caution that since government consumption comprises important components like goods, services, and regular maintenance. Policymakers should be cautious when dealing with non-compensation related public consumption given their long-term impact on growth and should have a granular approach, cutting non-useful and non-productive components of public consumption.

Finally, it is important to pay attention to the role the political economy dimension play in favoring some categories of spending over others. Compensation of employees is rigid, due to political sensitivity and implications. Investments are less rigid, but their acknowledged growth impact from one side and their political marketing and visibility from the other side play in favor of sheltering them in times of fiscal consolidation. Goods, services, and maintenance involve relatively low amount, and are not politically sensitive. Hence, this category is often underfunded in times of expansion and more prone to cuts in times of consolidation. A protracted lack of inputs to operate public services and substandard maintenance of equipment and infrastructure would reduce the performance of public services and constrain growth.

References

Agénor, P.-R. and K. C. Neanidis (2011): "The allocation of public expenditure and economic growth," *The Manchester School*, 79, 899–931.

Altunc, O. F. and C. Aydın (2013): "The relationship between optimal size of government and economic growth: Empirical evidence from Turkey, Romania and Bulgaria," *Procedia-Social and Behavioral Sciences*, 92, 66–75.

Anderson, G. and M. Raissi (2022): "Corporate indebtedness and low productivity growth of Italian firms," in *Essays in Honor of M. Hashem Pesaran: Panel Modeling, Micro Applications, and Econometric Methodology*, Emerald Publishing Limited.

Anderson, G., M. Raissi, and R. Goyal (2018): "Corporate Indebtedness and Low Productivity Growth of Italian Firms," *IMF Working Papers*, 2018.

Antolin-Diaz, J. and P. Surico (2022): "The long-run effects of government spending," Tech. rep., Tech. rep., mimeographed, London Business School.

Baltagi, B. H., G. Bresson, and A. Pirotte (2008): "To pool or not to pool?" in *The Econome- rics of Panel Data*, Springer, 517–546.

Baltagi, B. H. and J. M. Griffin (1997): "Pooled estimators vs. their heterogeneous counterparts in the context of dynamic demand for gasoline," *Journal of Econometrics*, 77, 303–327.

Barro, R. J. (1990). "Government spending in a simple model of endogenous growth." Journal of political economy 98 (5, Part 2), S103-S125.

Barro, R. J. (1981): "Output effects of government purchases," *Journal of Political Economy*, 89, 1086–1121.

Berg, A., E. F. Buffie, C. Pattillo, R. Portillo, A. F. Presbitero, and L.-F. Zanna (2019): "Some misconceptions about public investment efficiency and growth," *Economica*, 86, 409–430.

Berg, M. A., M. E. F. Buffie, M. C. A. Pattillo, R. Portillo, A. Presbitero, and L.-F. Zanna (2015): *Some misconceptions about public investment efficiency and growth*, International Monetary Fund.

Bergh, A. and M. Henrekson (2011): "Government size and growth: a survey and interpretation of the evidence," *Journal of Economic Surveys*, 25, 872–897.

Bersvendsen, T. and J. Ditzen (2021): "Testing for slope heterogeneity in Stata," *The Stata Journal*, 21, 51–80.

Blomquist, J. and J. Westerlund (2013): "Testing slope homogeneity in large panels with serial correlation," *Economics Letters*, 121, 374–378.

Boehm, C. E. (2020). "Government consumption and investment: Does the composition of purchases affect the multiplier?" Journal of Monetary Economics 115, 80-93.

Bou Habib, C., and Bronchi, C., (2022). "Keeping a long-term perspective can help countries implement fiscal adjustments." World Bank Blogs.

Bose, N., M. E. Haque, and D. R. Osborn (2007): "Public expenditure and economic growth: A disaggregated analysis for developing countries," *The Manchester School*, 75, 533–556.

Brixi, H., and Bronchi, C., (2021). “Investing in Human Capital for a Resilient Recovery: the Role of Public Finance.” World Bank Approach Paper.

Calderón, C., Moral-Benito, E., & Servén, L. (2015). “Is infrastructure capital productive? A dynamic heterogeneous approach.” Journal of Applied Econometrics, 30(2), 177-198.

Choi, C.-Y. and Y. S. Kim (2010): “Is there any asymmetry in the effect of inflation on relative price variability?” *Economics Letters*, 108, 233–236.

Chudik, A., K. Mohaddes, M. H. Pesaran, and M. Raissi (2016): “Long-run effects in large heterogeneous panel data models with cross-sectionally correlated errors,” in *Essays in Honor of Aman Ullah*, Emerald Group Publishing Limited.

——— (2017): “Is there a debt-threshold effect on output growth?” *Review of Economics and Statistics*, 99, 135–150.

Chudik, A., K. Mohaddes, M. H. Pesaran, M. Raissi, et al. (2013): “Debt, Inflation and Growth: Robust Estimation of Long-Run Effects in Dynamic Panel Data Models,” Tech. rep., Faculty of Economics, University of Cambridge.

Chudik, A. and M. H. Pesaran (2015): “Common correlated effects estimation of heterogeneous dynamic panel data models with weakly exogenous regressors,” *Journal of Econometrics*, 188, 393–420.

Clemens, M. A. and D. McKenzie (2018): “Why don’t remittances appear to affect growth?” *The Economic Journal*, 128, F179–F209.

Conway, K. S. (1997): “Labor supply, taxes, and government spending: a microeconometric analysis,”

Review of Economics and Statistics, 79, 50–67.

Dawood, T. C. and J. N. Francois (2018): “Substitution between private and government con- sumption in African economies,” *Economic Modelling*, 73, 129–139.

Devadas, S. and S. M. Pennings (2018): “Assessing the effect of public capital on growth: An extension of the World Bank Long-Term Growth Model,” *World Bank Policy Research Working Paper*.

Devarajan, S., V. Swaroop, and H.-f. Zou (1996): “The composition of public expenditure and economic growth,” *Journal of Monetary Economics*, 37, 313–344.

Eberhardt, M. and A. F. Presbitero (2015): “Public debt and growth: Heterogeneity and non- linearity,” *Journal of International Economics*, 97, 45–58.

Eberhardt, M. and F. Teal (2020): “The magnitude of the task ahead: Macro implications of heterogeneous technology,” *Review of Income and Wealth*, 66, 334–360.

Eden, M. and A. Kraay (2014). "Crowding in" and the returns to government investment in low-income countries. World Bank Policy Research Papers.

Ercolani, V. and J. V. e Azevedo (2014): “The effects of public spending externalities,” *Journal of Economic Dynamics and Control*, 46, 173–199.

Ericsson, N. R., J. S. Irons, and R. W. Tryon (2001): “Output and inflation in the long run,” *Journal of Applied Econometrics*, 16, 241–253.

Evans, P. and G. Karras (1996): “Private and government consumption with liquidity constraints,”

Journal of International Money and Finance, 15, 255–266.

Fall, F. and J.-M. Fournier (2015): "Macroeconomic uncertainties, prudent debt targets and fiscal rules," *OECD Economic Department Working Papers*, 0-1.

Fève, P., J. Matheron, and J.-G. Sahuc (2013): "A pitfall with estimated DSGE-based government spending multipliers," *American Economic Journal: Macroeconomics*, 5, 141–178.

Fiorito, R. and T. Kollintzas (2004): "Public goods, merit goods, and the relation between private and government consumption," *European Economic Review*, 48, 1367–1398.

Francois, J. N. (2022): "Habits, Rule-of-thumb Consumption and Useful Public Consumption in Sub-Sahara Africa: Theory and New Evidence," *Journal of African Economies*.

Francois, J. N., N. Ahmad, A. Keinsley, and A. Nti-Addae (2022): "Heterogeneity in the long-run remittance-output relationship: Theory and new evidence," *Economic Modelling*, 110, 105793.

Francois, J. N. and A. Keinsley (2019): "The long-run relationship between public consumption and output in developing countries: Evidence from panel data," *Economics Letters*, 174, 96–99.

Ganelli, G. and J. Tervala (2009): "Can government spending increase private consumption? The role of complementarity," *Economics Letters*, 103, 5–7.

Gaspar, V., Mauro, P., Pattillo C., and Espinoza, R., (2020): "Public Investment for the Recovery." IMF PFM Blog.

Ghosh, S. and A. Gregoriou (2008): "The composition of government spending and growth: is current or capital spending better?" *Oxford Economic Papers*, 60, 484–516.

Gupta, S., B. Clements, E. Baldacci, and C. Mulas-Granados (2005): "Fiscal policy, expenditure composition, and growth in low-income countries," *Journal of International Money and Finance*, 24, 441–463.

Gupta, S., A. Kangur, C. Papageorgiou, and A. Wane (2014): "Efficiency-adjusted public capital and growth," *World development*, 57, 164–178.

Harriss, C. L. (1956): "Government Spending and Long-Run Economic Growth," *The American Economic Review*, 46, 155–170.

Herrera, S. and G. Pang (2005): *Efficiency of public spending in developing countries: an efficiency frontier approach*, vol. 3645, World Bank Publications.

Herzer, D. and O. Morrissey (2013): "Foreign aid and domestic output in the long run," *Review of World Economics*, 149, 723–748.

Kaufmann, D., A. Kraay, and M. Mastruzzi (2011): "The worldwide governance indicators: methodology and analytical issues," *Hague Journal on the Rule of Law*, 3, 220–246.

Kitsios, E. and M. Patnam (2016): *Estimating fiscal multipliers with correlated heterogeneity*, International Monetary Fund.

Kneller, R., M. F. Bleaney, and N. Gemmell (1999): "Fiscal policy and growth: evidence from OECD countries," *Journal of public economics*, 74, 171–190.

Kormendi, R. C. (1983): "Government debt, government spending, and private sector behavior," *The American Economic Review*, 73, 994–1010.

Kose, M. A., S. Kurlat, F. Ohnsorge, and N. Sugawara (2022): "A cross-country database of fiscal space," *Journal of International Money and Finance*, 128, 102682.

Kraay, A. (2014): "Government spending multipliers in developing countries: evidence from lending by official creditors," *American Economic Journal: Macroeconomics*, 6, 170–208.

Linnemann, L. and A. Schabert (2006): "Productive government expenditure in monetary business cycle models," *Scottish Journal of Political Economy*, 53, 28–46.

Lu, Jiajun, and Yueteng Zhu (2021): "The asymmetric government spending multipliers: Evidence from US regions." *Economics Letters*, 208 110056.

Mohaddes, K., M. Raissi, and A. Weber (2017): "Can Italy grow out of its NPL overhang? A panel threshold analysis," *Economics letters*, 159, 185–189.

Mohaddes, M. K. and M. M. Raissi (2014): *Does Inflation Slow Long-Run Growth in India?*, International Monetary Fund.

Ndulu, B. J. and S. A. O'Connell (2021). "Africa's Development Debts." *Journal of African Economies*, 30(Supplement_1), i33-i73.

Ormaechea, M. S. A. and A. Morozumi (2013): *Can a government enhance long-run growth by changing the composition of public expenditure?*, International Monetary Fund.

Owyang, M. T., Ramey, V. A., & Zubairy, S. (2013). Are government spending multipliers greater during periods of slack? Evidence from twentieth-century historical data. American Economic Review, 103(3), 129-134.

Pennings, S. (2017): "Long Term Growth Model (LTGM v4. 0)–Model Description," .

Pesaran, M. (2004): "General Diagnostic Tests for Cross Section Dependence in Panels," Tech. rep., Institute of Labor Economics (IZA).

Pesaran, M. H. (2015): "Testing weak cross-sectional dependence in large panels," *Econometric reviews*, 34, 1089–1117.

Pesaran, M. H. and R. Smith (1995): "Estimating long-run relationships from dynamic heterogeneous panels," *Journal of econometrics*, 68, 79–113.

Sheremirov, V., & Spirovska, S. (2022). Fiscal multipliers in advanced and developing countries: Evidence from military spending. Journal of Public Economics, 208, 104631.

Pesaran, M. H. and T. Yamagata (2008): "Testing slope homogeneity in large panels," *Journal of econometrics*, 142, 50–93.

Pritchett, L. (1996): "Mind your P's and Q's: the cost of public investment is not the value of public capital," Tech. rep., The World Bank.

Sheremirov, V. and S. Spirovska (2022). "Fiscal multipliers in advanced and developing countries: Evidence from military spending." Journal of Public Economics 208, 104631.

Swamy, P. A. (1970): "Efficient inference in a random coefficient regression model," *Econometrica: Journal of the Econometric Society*, 311–323.

Tervala, J. (2009): "Productive Government Spending and Private Consumption," *Economics Bulletin*.

World Bank (2022): "The Impact of the War in Ukraine on Global Trade and Investment." *Wash- ington, DC*, available at: https://openknowledge.worldbank.org/handle/10986/37359 License: CC BY 3.0 IGO.

York, R. (2012): "Asymmetric effects of economic growth and decline on CO2 emissions," *Nature Climate Change*, 2, 762–764.

Zubairy, S. (2014): "On fiscal multipliers: Estimates from a medium scale DSGE model," *International Economic Review*, 55, 169–195.

Annex A: Summary Statistics

Table A.1: Summary Statistics

Variable	No. of Obs	Mean	Std. Dev.	Min.	Max.
			Full Sample		
Change in public investment (divided by lagged GDP)	4343	0.002	0.018	-0.231	0.275
Change in public consumption (divided by lagged GDP)	4343	0.005	0.015	-0.173	0.279
GDP growth	4343	0.037	0.044	-0.502	0.395
			HICs/HIEs		
Change in investment (divided by lagged GDP)	1576	0.001	0.007	-0.044	0.038
Change in public consumption (divided by lagged GDP)	1576	0.005	0.006	-0.045	0.045
GDP growth	1576	0.031	0.035	-0.215	0.266
			UMICs		
Change in investment (divided by lagged GDP)	954	0.002	0.017	-0.126	0.16
Change in public consumption (divided by lagged GDP)	954	0.005	0.012	-0.135	0.078
GDP growth	954	0.04	0.046	-0.24	0.395
			LMICs		
Change in investment (divided by lagged GDP)	1285	0.003	0.023	-0.231	0.275
Change in public consumption (divided by lagged GDP)	1285	0.005	0.019	-0.173	0.279
GDP growth	1285	0.039	0.043	-0.265	0.264
			LICs		
Change in investment (divided by lagged GDP)	486	0.004	0.024	-0.131	0.161
Change in public consumption (divided by lagged GDP)	486	0.006	0.023	-0.122	0.228
GDP growth	486	0.043	0.062	-0.502	0.352

Annex B: List of countries for the estimation

Table B.1: List of countries in the estimation sample

HICs	Code	HICs	Code	UMICs	Code	LMICs	Code
Australia	AUS	Singapore	SGP	North Macedonia	MKD	Nigeria[a]	NGA
Austria	AUT	Slovak Republic	SVK	Paraguay	PRY	Pakistan	PAK
Bahamas, The	BHS	Slovenia	SVN	Peru	PER	Philippines	PHL
Belgium	BEL	Spain	ESP	Russian Federation	RUS	Senegal	SEN
Brunei Darussalam	BRN	Sweden	SWE	Serbia	SRB	Sri Lanka	LKA
Canada	CAN	Switzerland	CHE	South Africa	ZAF	Tanzania	TZA
Chile	CHL	United Kingdom	GBR	Thailand	THA	Tunisia	TUN
Croatia	HRV	United States	USA			Ukraine[a]	UKR
Cyprus	CYP			**LMICs**			
Czechia	CZE	**HIEs**		Algeria	DZA	**LICs**	
Denmark	DNK	Hong Kong SAR, China	HKG	Bangladesh	BGD	Burkina Faso[a]	BFA
Estonia	EST	Macao/Macau SAR, China	MAC	Benin	BEN	Chad[a]	TCD
Finland	FIN			Bhutan	BTN	Congo, Dem. Rep.[a]	COD
France	FRA	**UMICs**		Bolivia	BOL	Madagascar	MDG
Germany	DEU	Argentina	ARG	Cambodia	KHM	Mali[a]	MLI
Greece	GRC	Armenia	ARM	Cameroon[a]	CMR	Mozambique[a]	MOZ
Hungary	HUN	Belize	BLZ	Comoros[a]	COM	Niger[a]	NER
Iceland	ISL	Botswana	BWA	Congo, Rep.[a]	COG	Rwanda	RWA
Ireland	IRL	Brazil	BRA	Egypt, Arab Rep.	EGY	Sierra Leone	SLE
Italy	ITA	Bulgaria	BGR	El Salvador	SLV	Sudan[a]	SDN
Japan	JPN	Costa Rica	CRI	Eswatini	SWZ	Syrian Arab Republic[a]	SYR
Korea, Rep.	KOR	Dominican Republic	DOM	Haiti[a]	HTI	Togo	TGO
Latvia	LVA	Ecuador	ECU	Honduras	HND	Uganda	UGA
Lithuania	LTU	Gabon	GAB	India	IND		
Luxembourg	LUX	Guatemala	GTM	Indonesia	IDN	**Unclassified**	
Netherlands	NLD	Jordan	JOR	Iran, Islamic Rep.	IRN	Venezuela, RB[a]	VEN
New Zealand	NZL	Kazakhstan	KAZ	Kenya	KEN		
Norway	NOR	Malaysia	MYS	Lebanon[a]	LBN		
Panama	PAN	Mauritius	MUS	Lesotho	LSO		
Poland	POL	Mexico	MEX	Mauritania	MRT		
Portugal	PRT	Moldova	MDA	Morocco	MAR		
Romania	ROU	Namibia	NAM	Nicaragua	NIC		

Notes: High income countries (HICs), High income economies (HIEs), Upper middle-income countries (UMICs), Lower middle-income countries (LMICs), and Low-income countries (LICs). Countries with superscript [a] are FCS.