INTERNATIONAL MONETARY FUND

Revisiting Fiscal Multipliers for Estonia

Carlos de Resende and Sadhna Naik

SIP/2025/101

IMF Selected Issues Papers are prepared by IMF staff as background documentation for periodic consultations with member countries. It is based on the information available at the time it was completed on June 23, 2025. This paper is also published separately as IMF Country Report No 25/182.

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Revisiting Fiscal Multipliers for Estonia
Prepared by Carlos de Resende and Sadhna Naik

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July 2025

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ABSTRACT: This Selected Issues Paper revisits fiscal multipliers for Estonia with a view to highlighting policy trade-offs and providing growth-friendly options for fiscal consolidation. The pandemic triggered a sharp and partly permanent increase in government spending. Demand for better quality and broader provision of public services has materialized, while climate and ageiong-related spending pressures are set to intensify over time and geopolitical risks have triggered a sharp increase in defense spending. Despite the 2022–2024 protracted recession, Estonian authorities have responded to these pressures with two rounds of wide-ranging tax changes affecting PIT, CIT, VAT, and excises, while spending cuts based on comprehensive spending reviews were enacted. Do these measures have significant short-term effects on growth? Granular estimates of fiscal multipliers by type of instrument—on both revenue and spending—can shed light on potential short-term output costs and underpin policy advice on specific instruments for fiscal consolidation. Our results indicate that multiplier effects in Estonia are not negligible. First-year multiplier estimates tend to fall in a 0.85–1.4 range for a general fiscal shock, 0.6–1.2 for aggregate spending, and about -0.2 for revenue. Granular multipliers suggest initially larger but less persistent output costs of spending cuts relative to tax increases.

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Revisiting Fiscal Multipliers for Estonia

Republic of Estonia

Prepared by Carlos de Resende and Sadhna Naik

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ANNEXES

REVISITING FISCAL MULTIPLIERS FOR ESTONIA[1]

This Selected Issues Paper revisits fiscal multipliers for Estonia with a view to highlighting policy trade-offs and providing growth-friendly options for fiscal consolidation. The pandemic triggered a sharp and partly permanent increase in government spending. Demand for better quality and broader provision of public services has materialized, while climate and ageiong-related spending pressures are set to intensify over time and geopolitical risks have triggered a sharp increase in defense spending. Despite the 2022–2024 protracted recession, Estonian authorities have responded to these pressures with two rounds of wide-ranging tax changes affecting PIT, CIT, VAT, and excises, while spending cuts based on comprehensive spending reviews were enacted. Do these measures have significant short-term effects on growth? Granular estimates of fiscal multipliers by type of instrument—on both revenue and spending—can shed light on potential short-term output costs and underpin policy advice on specific instruments for fiscal consolidation. Our results indicate that multiplier effects in Estonia are not negligible. First-year multiplier estimates tend to fall in a 0.85–1.4 range for a general fiscal shock, 0.6–1.2 for aggregate spending, and about -0.2 for revenue. Granular multipliers suggest initially larger but less persistent output costs of spending cuts relative to tax increases.

A. Introduction: Fiscal Multipliers

1. Fiscal multipliers measure the short-term impact of *discretionary* fiscal policy on output. Usually defined as the ratio of a change in output to an exogenous change in a fiscal instrument, fiscal multipliers can play a critical role in macroeconomic forecasts and should be taken into consideration for police advice and design.[2] Misrepresentations of fiscal multipliers can critically undermine the credibility of fiscal consolidations.

2. Estimations of fiscal multipliers are plagued with unresolved analytical challenges, which create uncertainty about their size. The main challenge is to isolate the direct effect of changes in fiscal variables on GDP, because of the two-way causality between them. Both spending and taxes typically can react mechanically to the business cycle through so-called “automatic stabilizers” (i.e., higher tax buoyancy during economic booms or larger unemployment benefits paid during recessions) and can also respond in a discretionary way (i.e., policymakers deciding to engineer a countercyclical response to cushion the impact of certain shocks on output). Using a range of different methodologies, researchers have tried to address this issue by attempting to identify “exogenous shocks” to fiscal policy—changes in spending or revenue not induced by the macroeconomic environment. With no consensus on the ideal methodology to address the issue, the literature lacks consensus on the size of multipliers.

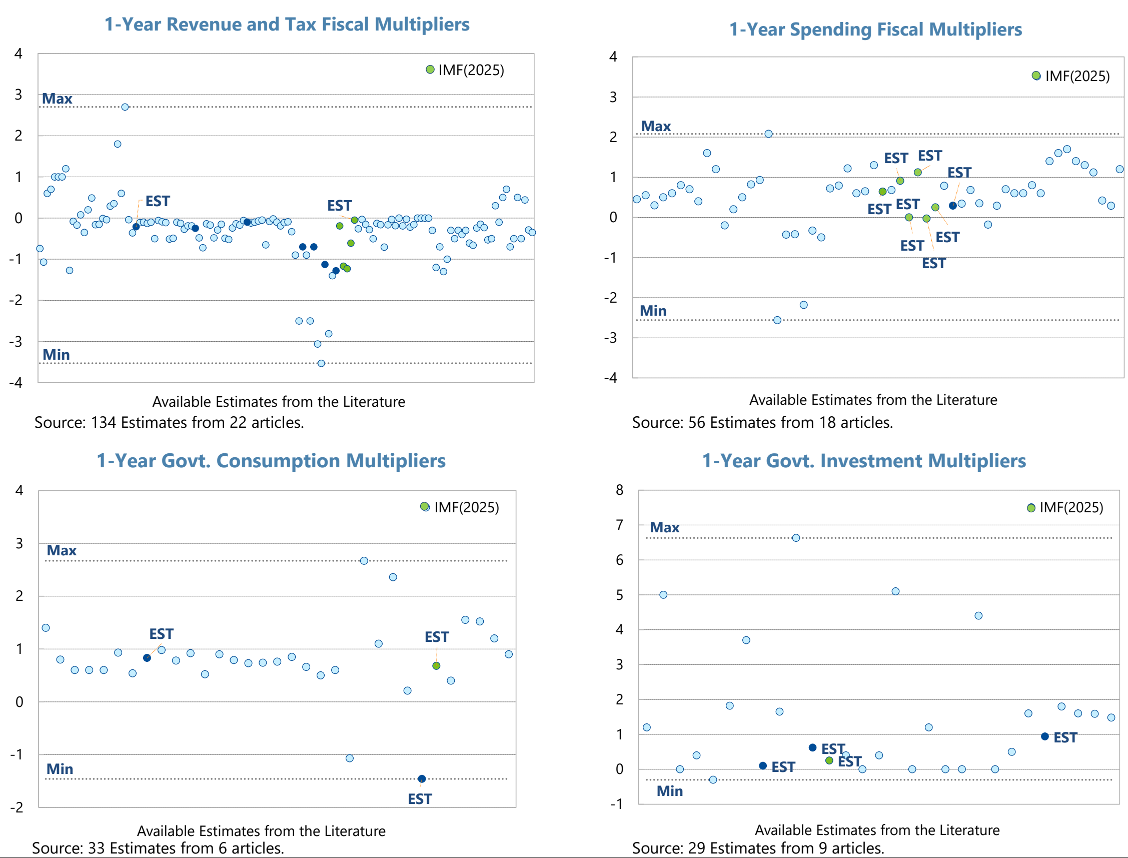
[1] Prepared by Carlos de Resende and Sadhna Naik (EUR).

[2] Fiscal multipliers only refer to short-term effects of changes in fiscal variables on GDP, offering little guidance on the effect on both other important variables—such as employment, social outcomes, and income distribution—and long-term (potential) GDP.

3. The literature about fiscal multipliers relies on two main approaches for identification of fiscal shocks. One identification strategy uses Structural Vector Autoregression (SVAR) techniques developed by Blanchard and Perotti (2002) and the other uses a narrative approach (Romer and Romer 2010, Devries et al. 2011).[3] This SIP, building on previous work by IMF (2021), focuses on an application of the SVAR approach to Estonia, while also examining other off-the-shelf methods developed by IMF staff.[4]

4. Estimates from the literature generally support the canonical Keynesian views. Figure 1 sums up estimates of one-year fiscal multipliers from 37 papers published between 2002 and 2025, using data from advanced economies, including this SIP (discussed later). Most estimates agree with conventional Keynesian theory: tax multipliers are negative, and spending multipliers are positive. For instance, 110 out of 134 estimates of one-year tax or fiscal revenue multipliers (Annex II) show negative values, 95 of which are between zero and -1. Considering 56 estimates of spending multipliers, 46 are positive (33 between zero and 1).

Figure 1. Advanced Economies: Estimates of Fiscal Multipliers



[3] For non-exhaustive reviews of the literature, including the different approaches used, see IMF (2013), Gechert (2015), and Deb et *al* (2021). Gechert (2015) and Hlaváček and Ismayilov (2022) provide systematic statistical meta-analysis of fiscal multiplier estimates.

[4] See Batini *et al* (2014) and IMF (2021).

5. Estimates of government consumption and investment multipliers are less common but are also in line with Keynesian tradition. All but 2 out of 33 estimates of government consumption multipliers are positive. Similarly, 22 out of 29 estimates of public investment multipliers are positive, although results are considerably more diverse than those in the other categories. Estimates for Estonia (marked dark blue and green in Figure 1) broadly align with the bulk of available estimates, except for one negative estimate of government consumption multiplier in Klyviene and Jakaitene (2022) and for government investment multipliers, which tend to be concentrated at the lower end.

B. The IMF's "Bucket Approach"

6. The IMF' "Bucket Approach" (BA) is a back-of-the-envelope method based on general findings from the literature relating the size of multipliers with countries' selected structural characteristics. The approach (see Batini et al, 2014) classifies countries into low, medium, or high multiplier groups (or "buckets") based on scores assigned to these characteristics. The resulting estimates based on this approach refer to first-year multipliers for a general fiscal shock, i.e., without a distinction between spending and tax multipliers.

7. Six structural characteristics are considered in the BA. A score of 1 is assigned to low trade openness, low labor market flexibility, weak automatic stabilizers, low exchange rate flexibility, "safe" levels of government debt, and highly effective public financial management. Otherwise, the score is zero.[5] These structural characteristics are associated with larger multipliers in "normal times" (i.e., GDP close to its potential level) and receive equal weight in the aggregate score, which is a sum of the individual scores for each factor. Countries are assigned multiplier values according to Table 1.

Table 1. Estonia: IMF's Bucket Approach: Ranges of First-Year "Normal Times" General Fiscal Multipliers

Score	Country Category	Multiplier Ranges
0 - 3	Low multiplier	0.1 – 0.3
3 - 4	Medium multiplier	0.4 – 0.6
4 - 6	High multiplier	0.7 – 1.0

8. Depending on the country's position on the business cycle and the prevailing monetary policy stance, the size of multipliers for normal times needs to be adjusted. For instance, if the economy is close to the lowest point in the cycle (largest negative output gap) by historical patterns, both the lower and upper bounds of multiplier ranges in Table 1 are increased by 60 percent, under this approach. Conversely, if the economy is close to the peak, both those bounds are reduced by 40 percent. Regarding the stance of monetary policy, if it is close to the effective

[5] See Batini et al (2014) for a more detailed discussion on how these factors affect the size of the fiscal multiplier.

zero-lower bound for the policy rate or constrained by some other reason, the multiplier range is increased by up to 30 percent.

9. The BA applied for Estonia implies a medium to high fiscal multiplier during normal times. Table 2 displays the scores assigned to each BA category for Estonia. The Estonian economy is very open, with average import-to-domestic demand ratios significantly above the 30 percent threshold assumed under the BA. In addition, labor markets are perceived as somewhat, but not highly, flexible. These two factors, especially the former, contribute to a lower estimate for the size of the fiscal multiplier. On all other structural criteria, Estonia scores high, indicating a larger fiscal multiplier. Automatic stabilizers (proxied by a public spending ratio to GDP below 40 percent) are thought to be weak, the exchange rate against most trading partners is fixed (as Estonia is part of a monetary union), public debt is the smallest in Europe in percent of GDP, and its public finance management is considered sound by international standards.[6] The resulting score of 4.5 suggests a value in the high-multiplier range of Table 1. The mid-rage estimate is 0.85.

Table 2. Estonia: IMF's Bucket Approach Applied to Estonia as of 2025Q1

Factor	Score (0 = no, 1 = yes)
Low trade openness	0
High Labor market rigidity	0.5
Weak automatic stabilizers	1
Quasi-fixed exchange rate	1
Low/safe public debt level	1
Effective PFM and Revenue Administration	1

10. Considering the protracted slowdown in economic activity in Estonia over the past three years, the estimated normal times multiplier needs to be adjusted upwards. Staff estimates the output gap in 2024 at -2 percent of potential GDP and expects it to remain broadly unchanged in 2025, starting to converge towards zero only after 2026. This is the largest negative output gap observed in Estonia since 2012, when the economy was still recovering from the Global Financial Crisis (GFC). By applying the suggested 60 percent adjustment for large negative output gaps, the estimate for Estonia becomes 0.85 x (1+0.6) = 1.36, with the adjusted lower bound (see Table 1) at 0.7 x 1.6 = 1.12.

C. Static Keynesian Fiscal Multipliers

11. Static spending multipliers can be derived from the canonical Keynesian aggregate demand equation determining short-run output. The textbook definition depends on the propensity to consume over the disposable income (which in turn depends on saving rate and net

[6] Estonia is ranked 86 out of 165 countries according to the labor flexibility component of the 2022 Frasier Institute's Economic Freedom Ranking, with a normalized score of 0.56 in the 0-1 interval. On government effectiveness, the country ranks 25 with a normalized score of 0.8.

tax rate), and the import contents of private consumption, public consumption, and public investment. For any exogenous expenditure A_i:

$$\kappa_i = \frac{\Delta \mathrm{Y}}{\Delta \mathrm{A}_i} = \frac{1 - m_i}{1 - c(1 - m_c)} = \frac{1 - m_i}{1 - (1 - t - s)(1 - m_c)},$$

where κ_i is the static fiscal multiplier for A_i, for i = public consumption or public investment; m_i is the import intensity of A_i; m_c is the import intensity of private consumption; and c, t, and s are the propensity to consume of private consumption, the average tax rate, and the savings rate, respectively. The import intensity of each type of expenditure represents the leakages through imports.[7]

12. Estimations of static multipliers for Estonia are consistent with the sizeable estimates obtained using the BA. Table 3 displays the relevant parameters and the resulting fiscal multipliers for public consumption and investment, estimated to be about 1.4 and 1, respectively. Due to lack of data specific to public investment, the multiplier for public investment assumes the same import intensity of total investment. Considering the combined import intensities of both categories of expenditure, the static multiplier is 1.16.

Table 3. Estonia: Average Static Fiscal Multipliers (2024-2030)

	Public Consumption (G)	Public Investment (I)	Combined G and I
Static Fiscal Multiplier	1.44	0.96	1.16
Import intensity (m_i)	0.12	0.41[/1]	0.29
direct	0.04	0.25	0.16
indirect	0.08	0.16	0.13
A. Tax Revenue (ratio to GDP)		0.357	
B. Transfers and Subsidies (ratio to GDP)		0.191	
A – B = Net Tax Rate (t)		0.166	
Private Savings Rate (s)		0.218	
Propensity to consume ($c = 1 - t - s$)		0.617	
Import intensity of private consumption (m_c)		0.372	

[/1] Uses the import intensity of total investment as proxy for that of public investment.

D. Blanchard-Perotti SVAR Approach

13. Structural Vector Autoregressive (SVAR) models—e.g., Blanchard and Perotti (2002)—are widely used to estimate fiscal multipliers. To isolate exogenous changes in fiscal variables

[7] The coefficients t and s are obtained as total tax revenues (including social contributions) net of transfers and domestic private savings in percent of GDP, respectively. The import contents of private consumption, government consumption and public investment were constructed using the 2020 input-output matrix for Estonia and reflect the share of expenditure that is imported, directly or indirectly (i.e., through the consumption of domestically goods and services that are produced using imports). See Bussière *et al* (2013).

that are orthogonal to economic developments, the BP approach relies on the identification assumption that discretionary changes in government spending triggered by unexpected macroeconomic news are unlikely to be implemented within shorter time intervals (e.g., a quarter) due to implementation lags. That leaves two possible causes for changes in fiscal variables within, say, a quarter: (*i*) an automatic response to macroeconomic variables (i.e., automatic stabilizers) or (*ii*) truly exogenous shifts in fiscal policy (i.e., fiscal shocks). Independently estimated or calibrated elasticities of revenue and expenditure items with respect to output are then imposed as non-zero restrictions to an otherwise standard VAR and used to identify the effect of automatic stabilizers, leaving the fiscal shock identified.[8] For spending shocks, identification is achieved by assuming that government spending is pre-determined within the quarter, using a standard Cholesky decomposition with government spending ordered first. For tax shocks, taxes are ordered first (i.e., tax decisions are assumed to be taken first, with spending responding). A more detailed discussion of BP's identification strategy is presented in Annex I.

14. Our estimation of the reduced-form VAR includes several dummy variables and exogenous controls. The estimation uses Estonian quarterly data on real GDP, total government spending, and total fiscal revenues from 2001Q1 to 2024Q2. To account for unit roots and trends in underlying variables, we normalized all variables by the trend in GDP (HP-filtered) and included both linear and quadratic deterministic trends, when statistically significant, as exogenous regressors in the estimation of the reduced-form VAR equations. Following BP (2002), we also added both seasonal dummies and indicators of known tax reforms in Estonia.[9] The former are interacted with data on GDP, taxes, and spending to capture seasonal patterns in the response of taxes to economic activity. This allows for the coefficients in the VAR to be quarter-specific within the year.[10] To control for the effects of the monetary policy stance, commodity prices, and foreign demand on GDP, government revenues and spending, the estimation includes the ECB policy rate, a terms-of-trade index, and the trade-weighted foreign partners' GDP, as exogenous variables in the SVAR. The impulse response functions, however, are later computed without the quarterly dependence dummies (i.e., they capture the average dynamic response to fiscal shocks across quarters within the

[8] More specifically, the BP approach builds on the recursive VAR approach by Fatás and Mihov (2001)—which relies on a standard Cholesky factor decomposition based on the causal ordering of variables to rule out contemporaneous reactions of the fiscal variable to business cycle variations—by adding the non-zero restrictions containing the elasticities.

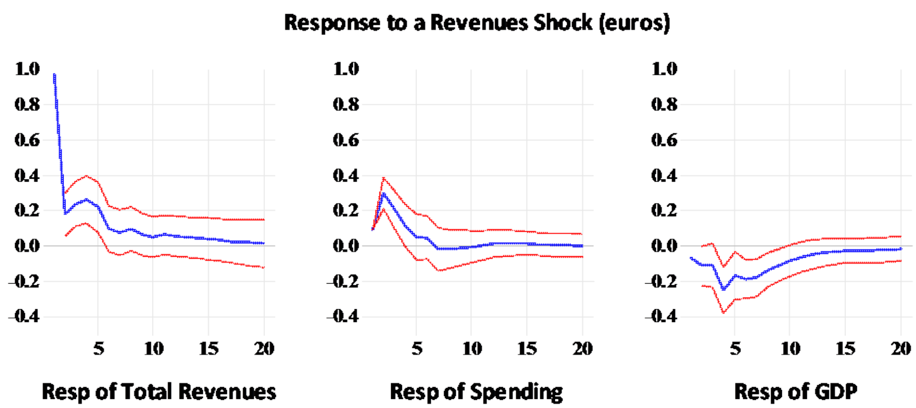
[9] We used information from the European Commissions' 2021 Taxation Trends Report complemented by our institutional knowledge about Estonia's tax system during 2022-2024, to construct the dummies for tax reforms. We considered all changes in tax rates for personal and corporate income taxes and VAT. See (https://taxation-customs.ec.europa.eu/taxation/economic-analysis/data-taxation-trends_en).

[10] This goes beyond simply seasonally adjusting quarterly data. The seasonal dummies are interacted with the underlying series of GDP, tax, and spending. Because the timing of tax collection may not be uniformly distributed within the year, shocks to GDP can have different effects on tax revenues depending on the quarter. For instance, a tax that is usually paid in the last quarter of the year may depend on GDP in the current and past three quarters, but tax collection will show as zero in the other three quarters.

year) and normalized to represent the response, in euros, to a one-euro shock in the selected fiscal instrument.[11]

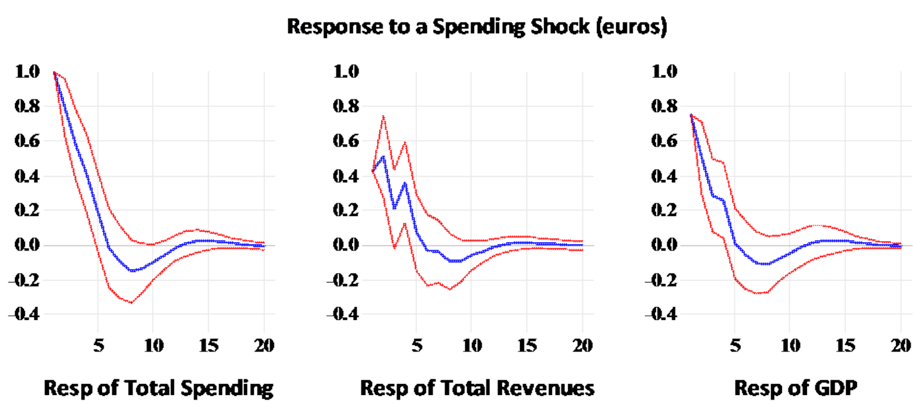
15. Multiplier estimates from Blanchard-Perotti's SVAR approach suggest negative and positive responses of real GDP to exogenous increases in total revenues and spending net of interest income and payments, respectively. Considering only statistically significant responses (at 5 percent) to a one-euro shock, Figures 2–3 show that real GDP *falls* for 10 quarters following exogenous increases in total net revenues—with a (non-cumulative) peak response of -0.25 euro after 4 quarters—and *increases* by about 0.7 euro immediately after a spending shock, with a non-cumulative response that gradually decreases but remains statistically significant up to 4 quarters.

Figure 2. Fiscal Multipliers in Estonia: Total Revenues[1]



Source: IMF staff estimations. Red lines are 95% confidence bands.
1/ Excludes interest income.

Figure 3. Fiscal Multipliers in Estonia: Total Spending[1]



Source: IMF staff estimations. Red lines are 95% confidence bands.
1/ Excludes interest expenditures.

[11] The original impulse responses (*IRF*) are elasticities of GDP to autonomous changes in fiscal instrument i (i.e., $IRF = (\Delta GDP/GDP)/(\Delta A_i/A_i)$). The normalized impulse responses are calculated by dividing *IRF* by the average share of the fiscal instrument to GDP such that $IRF^{*} = \Delta GDP/\Delta A_i$.

16. To estimate granular fiscal multipliers for different categories of revenues and spending, we applied a slightly modified version of the BP approach. We included the fiscal instrument of interest (e.g., VAT revenues) as an endogenous variable in the VAR system and added its corresponding aggregated variable (e.g., total revenues) as part of the exogenous controls. Following Ramey and Zubairy (2018), the cumulative multiplier $k_i(h)$, for fiscal instrument i at horizon h is calculated as:[12]

$$k_i(h) = \frac{\sum_{t=1}^{h} response\ of\ GDP\ at\ quarter\ t}{\sum_{t=1}^{h} response\ of\ instrument\ i\ at\ quarter\ t}.$$

17. Table 4 shows that multipliers vary significantly by type of fiscal instrument. In addition to total revenue and total spending net of interest flows, we estimated multipliers for four types of revenues—i.e., direct taxes, its two subcategories of personal (PIT) and corporate income (CIT) taxes, and VAT—six categories of spending—i.e., government consumption, its two subcomponents (wages and salaries and intermediate consumption), subsidies, transfers, and public capital formation. To account for the possibility that the effects of fiscal policy build over time, Table 4 reports cumulative multipliers at one and two years after the shock.

18. The one-year aggregate spending multiplier is larger in absolute terms than the revenue multiplier. Results in Table 4 for first-year multipliers are consistent with results in Carnot and Castro (2015) for the European Union, which suggest that the average one-year aggregate spending multiplier is between two to three times as large (in absolute terms) as revenue multipliers, and with the meta-regression analysis of 104 studies by Gersher (2015), which reports spending multipliers exceeding tax multipliers by 0.3–0.4 unit. Our estimates are also broadly consistent with, albeit somewhat smaller than, the results from a survey of 41 VAR or DSGE studies by Mineshima *et al* (2014), which suggests that first-year multipliers amount on average to 0.75 for government spending and -0.25 for government revenues in advanced economies. This is in line with the Keynesian notion that the effect of tax changes is dampened by savings while changes in public spending have a direct impact on aggregate demand.[13] Focusing on aggregate spending, our result based on the BP approach is also consistent with the meta-analysis statistical study of 132 papers by Hlaváček and Ismayilov (2022), which finds spending multipliers in the range of 0.75–0.82.

19. Fiscal multipliers for tax shocks are consistently negative on impact (i.e., within a quarter) and tend to be more persistent than spending multipliers. Except for the VAT and CIT multipliers, which decline (in absolute terms)—to almost zero and by 40 percent, respectively—after one year and peak in one or two quarters, respectively, tax multipliers tend to remain negative and become stronger over a two-year horizon (Table 4). Multipliers for total net revenues, direct taxes taken as a whole, and PIT all build up over time, reflecting the lower persistence of the tax/revenue

[12] We only considered statistically significant responses at the 5 percent level.

[13] Papers that use the narrative approach to identify exogenous fiscal shocks, tend to find larger tax multipliers than conventional VAR models do and do not generally support the view that spending multipliers are larger than revenue ones. See Romer and Romer (2010), Ramey (2011), and Alesina et al (2019).

shock relative to that of its effect on GDP. For example, within two years after the shock, the negative multiplier effect of direct taxes on GDP doubles, driven by the effect of PIT which becomes three times as strong.

Table 4. Estonia: Impact and Cumulative Fiscal Multipliers of Selected Fiscal Instruments

Fiscal Instrument	1st quarter	After 4 quarters	After 8 quarters	Peak / Through
Total Revenues	-0.07	-0.19	-0.52	-0.52 (8th quarter)
Direct Taxes	-0.62	-1.17	-1.21	-1.32 (7th quarter)
PIT	-0.54	-1.23	-1.47	-1.59 (7th quarter)
CIT	-1.07	-0.61	-0.84	-1.07 (1st quarter)
VAT	-0.35	-0.05	0.19	-0.35 (2nd quarter)
Total Spending	0.75	0.64	0.64	0.75 (1st quarter)
Government Consumption	1.05	0.68	0.35	1.05 (1st quarter)
Wages and Salaries/1	1.89	0.91	0.38	1.89 (1st quarter)
Intermediate consumption	0.01	0.00	0.00	0.01 (1st quarter)
Subsidies	0.50	1.12	1.50	1.50 (8th quarter)
Transfers	0.69	-0.03	-0.10	0.69 (1st quarter)
Gross Fixed Capital Formation	-0.02	0.25	0.17	0.30 (2nd quarter)

Note: Only statistically significant responses at the 5 percent level are considered in the computation of multipliers.
/1 includes employers' social contributions

20. Spending shocks have a positive effect on output but, contrary to tax multipliers, tend to peak sooner after the shock and rapidly decay. All spending multipliers are positive on impact, except for that of public investment, which is nevertheless barely negative and becomes positive and peaks after two quarters. They all also decrease over time, peaking in the first or second quarter after the shock, possibly reflecting crowding out of private spending and Ricardian-equivalence channels. The exception is the multiplier of subsidies, which becomes three times stronger after two years, indicating that its positive effect on GDP builds up as subsidized programs mature.

21. Spending on wages and salaries has the largest immediate impact on GDP, but it fades by 80 percent in two years. When compounded with the almost null multiplier for intermediate consumption, the large multiplier for the public wage bill implies a still large (i.e., above one) multiplier for government consumption, in line with the static multipliers discussed on Table 3. The multiplier for transfers, the second highest on impact, shows a similar profile but, given the likely larger uncertainty of such flows, it may be associated with a larger propensity to save, which reduces its initial size and makes it fade more quickly.

22. Public investment multipliers are smaller than government consumption multipliers. This result from the BP approach confirms the findings with the static multipliers and the literature

(Klyviene and Jakaitene, 2022), likely reflecting the larger import content of investment relative to government consumption (which, on itself, is largely composed by spending with wages and salaries). A more useful comparison is with the fiscal multiplier of government intermediate consumption. In this case, Table 4 shows that the public capital formation has a generally larger positive and persistent effect on GDP than the purchase of consumption goods.

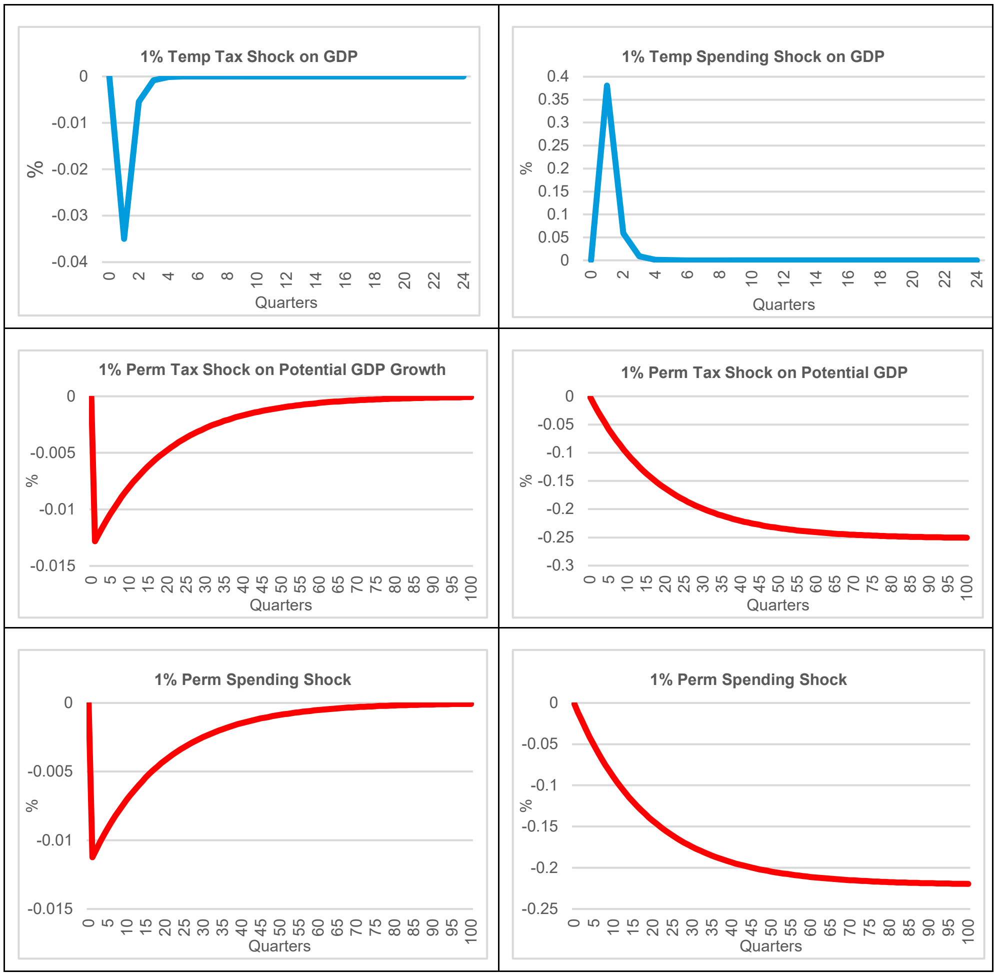
E. Estimating the Impact of Fiscal Shocks on Potential GDP

23. Traditional estimates of fiscal multipliers do not distinguish between temporary and permanent fiscal shocks and their effects on potential GDP. The standard methodologies used to estimate fiscal multipliers may capture cumulative or persistent output effects of fiscal shocks, but these effects potentially conflate cyclical and structural components. Even strands of the literature that take a longer-term perspective in analyzing effects of episodes of fiscal austerity on GDP (e.g., Alesina *et al*, 2019) do not explicitly disentangle the short-run and permanent effects of fiscal shocks.

24. For that purpose, we estimate a structural vector error correction model (SVECM). The model, estimated with Bayesian techniques using quarterly Estonian data on real GDP, total spending and total fiscal revenues from 2001Q1 to 2024Q2 (see Annex II), explicitly allows for permanent spending and tax shocks to affect both the business cycle (i.e., the output gap) and potential GDP growth, while restricting temporary fiscal shocks to only have effects on the cycle. The effects of permanent fiscal shocks are temporary on potential GDP *growth*, but permanent on its *level*. Figure 4 shows the effects of 1 percent fiscal shocks on GDP.

25. Both tax and spending permanent increases have a small but persistent *negative* effect on potential GDP growth, permanently *reducing* the level of GDP. The model was calibrated such that the immediate effects of temporary fiscal shocks match the results from the Blanchard-Perotti SVAR approach (when converted to euros). The prior distributions used accounted for a negative effect of permanent tax shock on GDP but were agnostic about the sign of the effect of permanent spending shocks. Figure 4 shows that the estimated impact of 1 percent permanent shocks to *both* revenues and spending leads to a little over 0.01 percentage points *decline* in (quarterly) potential GDP growth, which seems small at first glance. However, when compounded over 2 years, this amounts to about 0.1 percentage point lower GDP. Over 5 years, real GDP is about 0.2 and 0.15 percentage point lower following permanent increases in taxes and spending, respectively. In the long run, the cumulative effect on GDP is -0.25 and -0.22 percentage point, respectively. These results are in line with those in Alesina *et al* (2019) and suggest that fiscal austerity based upon spending cuts is much less costly (actually, not costly at all) in the long run than when based on tax increases.

Figure 4. Effects of Temporary and Permanent Fiscal Shocks on Output



Source: IMF staff estimations.

F. Conclusions

26. Estimated multipliers for Estonia consistently suggest non-negligible *negative* short-term effects of *both* exogenous government spending cuts and tax increases on output. Based on three different methods—(i) the IMF's BA, (ii) a static comparative approach given propensities to save and import, and (iii) the Blanchard-Perotti SVAR approach—the estimated first-year multipliers for general fiscal variables (1.1), aggregate spending (0.6–1.2) and net fiscal revenues (-0.2) fall well within results found in the literature and indicate important *short-term* costs of fiscal consolidation.

27. While multipliers for *aggregate* fiscal variables suggest larger but less persistent short-term output costs for spending cuts relative to revenue increases, the picture is more nuanced when considering more granular fiscal instruments. Our findings using the BP SVAR approach underscore the heterogeneity in the size and persistence of multipliers across different fiscal instruments. Notably, while one-year aggregate spending multipliers are larger than that for total revenues (in absolute terms), multipliers of direct tax shocks, especially PIT, build up over time and become larger than multipliers for any category of spending within one year and, except for subsidies, after two years of the initial shock. This suggests that the negative effects of direct tax hikes are highly persistent. Except for VAT shocks, which no longer exert negative impact on GDP after four quarters, similar persistent profiles (albeit with smaller multipliers), are also estimated for other categories of taxes and total revenues (i.e., including non-tax revenues). On the spending side, except for subsidies and public investment, multipliers tend to peak immediately after the shock and quickly decay. Spending on wages and salaries demonstrates the most substantial immediate impact on GDP, although this effect diminishes significantly within two years.

28. Our results highlight important trade-offs of potential strategies for fiscal consolidation based on short-term effects of multipliers for different fiscal instruments. For instance, *abstracting from other important considerations*—such as buoyancy and administrative burden of individual tax categories, progressivity of the tax system, income distribution, risks of tax avoidance behavior—that may be subject to independent policy goals, fiscal consolidations based on spending cuts, especially if based on reductions in the wage bill, should produce larger immediate negative output effect, albeit short-lived. Revenue-based consolidations, especially via direct taxes, will have slightly lower immediate effects than general spending cuts but output costs build over time and last longer. Focusing on two-year multipliers, which Ramey and Zubairy (2018) argue to best capture fiscal effects on output that build over time, considering the high persistence of direct tax multipliers, and sizes of different multipliers, spending cuts unrelated to subsidies or VAT tax hikes, may be the most growth-friendly options.

29. The long-term effects of both revenues and spending permanent shocks are *negative*. Differently from the traditional fiscal multiplier, (short-run) output effects of spending increases, which materialize over business cycle frequencies, permanent spending shocks lead to a small temporary *decline* in the growth rate of potential GDP, which translates into a *permanent reduction* in the level of GDP. Moreover, the negative output effect of permanent revenues shocks is larger (in absolute terms) than that of spending increases, suggesting that short-run costs of fiscal consolidations based on spending cuts will be, at least partially, offset by permanent positive effects on potential GDP.

Annex I. Shock Identification in the BP (2002) SVAR Approach

1. The BP strategy maps a reduced-form vector autoregression into a structural model. First, the reduced-form VAR represented by equations (1)–(3) below is estimated using seasonally adjusted quarterly, per capita data on real GDP, taxes, and spending, all in natural logarithms.

GDP (Y_t): $$Y_t = a_{11}Y_{t-1} + a_{11}T_{t-1} + a_{11}S_{t-1} + e_t^y, \quad (1)$$

Tax / Revenues (T_t): $$T_t = a_{21}Y_{t-1} + a_{22}T_{t-1} + a_{23}S_{t-1} + e_t^T, \quad (2)$$

Spending (S_t): $$S_t = a_{31}Y_{t-1} + a_{32}T_{t-1} + a_{33}S_{t-1} + e_t^S, \quad (3)$$

where e_t^y, e_t^T, and e_t^S are reduced-form VAR residuals (or forecast errors), assumed to be linked to structural shocks μ_t^y, μ_t^T, and μ_t^S, for Y_t, T_t, and S_t, respectively.

2. The unobserved uncorrelated structural shocks are then assumed to be linearly linked to the reduced-form residuals according to equations (4)–(6):

$$e_t^y = a_1 e_t^T + a_2 e_t^S + \mu_t^y, \quad (4)$$

$$e_t^T = b_1 e_t^y + b_2 \mu_t^S + \mu_t^T, \quad (5)$$

$$e_t^S = c_1 e_t^y + c_2 \mu_t^T + \mu_t^S, \quad (6)$$

where GDP forecast errors (e_t^y) are assumed to depend on surprises in both taxes ($a_1 e_t^T$) and spending ($a_2 e_t^S$), and on structural shocks to GDP (μ_t^y); forecast errors in taxes (e_t^T) relate to surprises in GDP ($b_1 e_t^y$), structural spending shocks ($b_2 \mu_t^S$), and structural shocks to taxes (μ_t^T); and, finally, unexpected movements in spending (e_t^S) are assumed to derive from GDP forecast errors ($c_1 e_t^y$), structural shocks to taxes ($c_2 \mu_t^T$), and structural shocks to government spending (μ_t^S).

3. Economic restrictions and estimations made outside the system (1)–(3) inform the values of structural parameters in equations (4)–(6). Because SVAR models contain more unknown coefficients than information in the reduced-form VAR, restrictions are needed on some parameters for full identification. The key structural restriction is to impose $c_1 = 0$ (spending does not change in response to GDP within the quarter). Additionally, for tax shocks it is assumed that $b_2 = 0$ (tax decisions are taken first and spending responds) and for spending shocks, that $c_2 = 0$ (spending decisions come first). In either case, c_2 or b_2 are estimated, respectively. Parameters b_1 (elasticity of taxes to GDP), a_1 and a_2 are estimated separately.[1]

[1] We estimate the tax elasticity to GDP as b_1 = 0.8, using a simple OLS regression of taxes on GDP. For robustness, we also used b_1 = 1, which is the estimate for Estonia in Koster and Priestmeier (2017). As reported by Restrepo (2020), the identified structural shocks are not very sensitive to the value of b_1. Also following Restrepo (2020), we constructed cyclically-adjusted taxes $r_t^T = e_t^T - b_1 e_t^y$ to be used as instrument for e_t^T in the estimation of equation (4), from which we obtain estimates of a_1 and a_2.

Annex II. A Structural Vector Error Correction Model for Assessing the Impact of Fiscal Shocks on Potential GDP

1. The SVECM model contains 10 endogenous variables distributed in three blocks of trend and cycle (i.e., deviations from trends) for real GDP, fiscal revenues, and total spending. In each block, there are *iid* innovations that affect the cyclical component (i.e., temporary shocks) and the trend components (i.e., permanent shocks).

1. $\hat{y}_t = \rho^y \hat{y}_{t-1} + \lambda^y \Omega_t^y - \lambda^T \varepsilon_{t-1}^T + \lambda^G \varepsilon_{t-1}^G - \beta^T \Delta\Phi_{t-1}^T + \beta^G \Delta\Phi_{t-1}^G + \varepsilon_t^y$ output gap
2. $\Delta\bar{y}_t = \rho^{\bar{y}} \Delta\bar{y}_{t-1} + (1-\rho^{\bar{y}})\Delta\bar{y} - \alpha^T \Phi_{t-1}^T + \alpha^G \Delta\Phi_{t-1}^G + \Delta\Phi_t^{\bar{y}}$ potential GDP growth
3. $\Delta y_t = \Delta\bar{y}_t + \Delta\hat{y}_t$. actual GDP growth
4. $\Omega_t^y = \sum_{h=1}^{H} \mu_h^y HFI_t(h)$ *H* exogenous HFIs

5. $\hat{\tau}_t = \epsilon^T \hat{y}_t + \varepsilon_t^T$ cyclical revenues
6. $\Delta\bar{\tau}_t = \rho^T \Delta\bar{\tau}_{t-1} + \epsilon^T \Delta\bar{y}_t + (1-\rho^T - \epsilon^T)\Delta\bar{y} + \Delta\Phi_t^T$ growth of cyclically adjusted revenues
7. $\Delta\tau_t = \Delta\bar{\tau}_t + \Delta\hat{\tau}_t$ growth of revenues

8. $\hat{g}_t = \epsilon^G \hat{y}_t + \varepsilon_t^G$ cyclical spending
9. $\Delta\bar{g}_t = \rho^G \Delta\bar{g}_{t-1} + \epsilon^{\bar{G}} \Delta\bar{y}_t + \left(1-\rho^G - \epsilon^{\bar{G}}\right)\Delta\bar{y} + \Delta\Phi_t^G$ growth of cyclically adjusted spending
10. $\Delta g_t = \Delta\bar{g}_t + \Delta\hat{g}_t$, growth of spending

where the 10 endogenous variables are $\hat{y}_t$, $\Delta\bar{y}_t$, Δy_t, Ω_t^y, $\hat{\tau}_t$, $\Delta\bar{\tau}_t$, $\Delta\tau_t$, $\hat{g}_t$, $\Delta\bar{g}_t$, Δg_t; variables y_t, τ_t, and g_t represent (the natural log of CPI-deflated, per capita) real GDP, fiscal revenues, and total public spending, respectively; a hat ($\hat{x}$) and a bar ($\bar{x}_t$) indicate the cyclical and trend components of each variable x_t, respectively, while Δx_t represents its (log-) change (i.e., the growth rate); innovations ε_t^y, ε_t^T, and ε_t^G are the 3 iid temporary shocks to cyclical GDP, revenues, and spending, respectively; and $\Delta\Phi_t^{\bar{y}}$, $\Delta\Phi_t^T$, and $\Delta\Phi_t^G$ are iid shocks to their trend *growth* (i.e., permanent shocks to the trend *levels*).

2. The growth rates of the trends in GDP, revenues, and spending are modelled to converge to the historical average GDP growth, $\Delta\bar{y}$. That assumption ensures that ratios of both revenues and spending to GDP converge to a constant. Both cyclical components of revenues and spending embed automatic stabilizers (i.e., elasticities to the business cycle; see equations 5 and 8), while their trend growth are related to potential GDP growth (via equations 6 and 9, respectively). The basic identification strategy is to assume that temporary shocks do not affect trends (i.e., no temporary fiscal shocks affecting equations 2, 6, and 9), but permanent shocks affect both cycles and trends (see equations 1-2, 5-6, and 8-9). To help better identify the business cycle, a composite variable Ω_t^y, which includes detrended series of capacity utilization, unemployment rate, goods imports, industrial production, retail sales, and an economic confidence indicator, is included in the output gap equation.

3. The estimation results are displayed in Table 1.

Annex II. Table 1: Estonia: SVECM Estimation Results

Parameter	Prior Distribution	Prior Moments mean	std	Posterior mode	Description, equation
ρ^{y}	Beta	0.8	0.2	0.155	AR coeff., $\hat{y}_t$
λ^{y}	Gamma	1	0.5	0.114	Macro HFIs, $\hat{y}_t$
β^{T}	Normal	0.05	1	0.045	Perm tax shock, $\hat{y}_t$
β^{G}	Normal	-0.05	1	-0.933	Perm spending shock, $\hat{y}_t$
μ_1^{y}	Gamma	1	0.5	0.450	Capacity Utilization,
μ_2^{y}	Gamma	1	0.5	1.214	Unemployment rate, Ω_t^{y} (-)
μ_3^{y}	Gamma	1	0.5	0.454	Imports of Goods, Ω_t^{y}
μ_4^{y}	Gamma	1	0.5	1.182	Industrial Production, Ω_t^{y}
μ_5^{y}	Gamma	1	0.5	0.652	Retail Sales, Ω_t^{y}
μ_6^{y}	Gamma	1	0.5	0.393	Car Sales, Ω_t^{y}
μ_7^{y}	Gamma	1	0.5	0.269	Economic Confidence Indicator Sales, Ω_t^{y}
$\rho^{\bar{y}}$	Beta	0.8	0.2	0.949	AR coeff., $\Delta\bar{y}_t$
α^{T}	Normal	0.05	0.2	0.053	LT tax distortions, $\Delta\bar{y}_t$ (-)
α^{G}	Normal	0	0.2	-0.048	LT spending distortions/externalities, $\Delta\bar{y}_t$ (?)
ρ^{τ}	Beta	0.8	0.2	0.493	AR coeff., $\Delta\bar{\tau}_t$
ϵ^{T}	Gamma	1.2	0.5	0.491	Income elasticity, $\Delta\bar{\tau}_t$
ρ^{G}	Beta	0.8	0.2	0.469	AR coeff., $\Delta\bar{g}_t$
$\epsilon^{\bar{G}}$	Normal	0	1	0.733	Income elasticity, $\Delta\bar{g}_t$
ϵ^{G}	Normal	0	1	-0.386	Income elasticity, $\hat{g}_t$

Source: IMF staff estimates.

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