REPUBLIC OF ESTONIA

SELECTED ISSUES

June 2024

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REPUBLIC OF ESTONIA

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May 23, 2024

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European Department	

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WHAT EXPLAINS ESTONIA'S RECENT LOSSES OF EXPORT MARKET SHARES[1]

Estonia's export market share has fallen sharply, signaling that exporters have difficulties to keep up with foreign competition. While the immediate cause of this decline can be traced back to an adverse combination of external shocks triggered by the war in Ukraine, signs of faltering export performance surfaced already in the aftermath of the global financial crisis, and thus predate recent shocks. Using a constant share decomposition, this paper shows that, unlike in Latvia and Lithuania, a significant portion of the decline in Estonia's export share can be attributed to the 'intensive margin', i.e., a shrinking share of Estonia's exports in the main destination markets—a sign of weakening external competitiveness and declining relative productivity.

A.   Introduction

1.   Estonia's export market share has fallen sharply in recent quarters, both in absolute terms and relative to developments in comparable economies. Having remained remarkably stable throughout the COVID-19 pandemic, Estonia's merchandise exports as a share of global exports have steadily declined for nine consecutive quarters, falling by 23 percent between 2021 Q3 and 2023 Q4 (Figure 1).

2.   The immediate cause of this decline was an adverse combination of external shocks. Notably, Russia's war on Ukraine has led to extensive disruptions in supply chains and increased input costs. Commodities such as timber and metals, previously supplied from Russia and Belarus, are now sourced from more expensive markets. Additionally, the euro's appreciation against the currencies of important trading partners, such as Sweden and Norway, has diminished the competitiveness of Estonian exporters, which specialize in medium- and low-tech goods, and hence tend to be relatively sensitive to price changes. Furthermore, the underperformance of key external markets, particularly the Scandinavian construction sector, has further depressed exports (Figure 1).

Figure 1. Export Market Share and Growth of Estonia's Top Export Markets

Sources: Direction of Trade Statistics, IMF; and IMF staff calculations.

Sources: Direction of Trade Statistics, IMF; World Economic Outlook, IMF; and IMF staff calculations.

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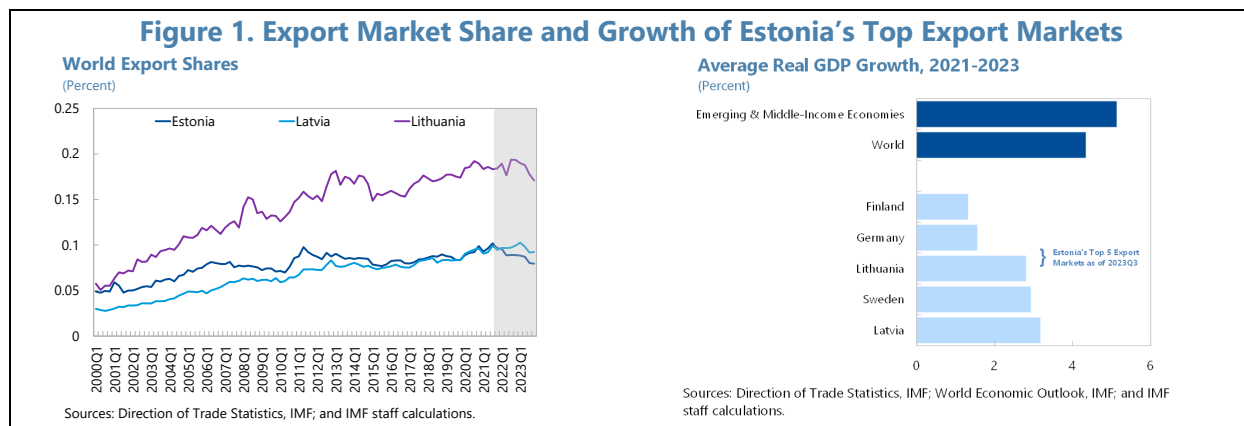
[1] Prepared by Gianluigi Ferrucci and Sadhna Naik.

3.   While the recent shocks may have exposed Estonia's underlying vulnerabilities, signs of a structural deterioration in the country's external performance and competitiveness predate the shocks. Productivity growth began faltering shortly after the global financial crisis, failing to keep pace with the appreciation of the real exchange rate. As a result, relative costs in Estonia have increased more than in the euro area. The recent significant adjustments in price and cost levels have exacerbated this trend (Figure 2).

Figure 2. ULC and HICP-based Real Effective Exchange Rate
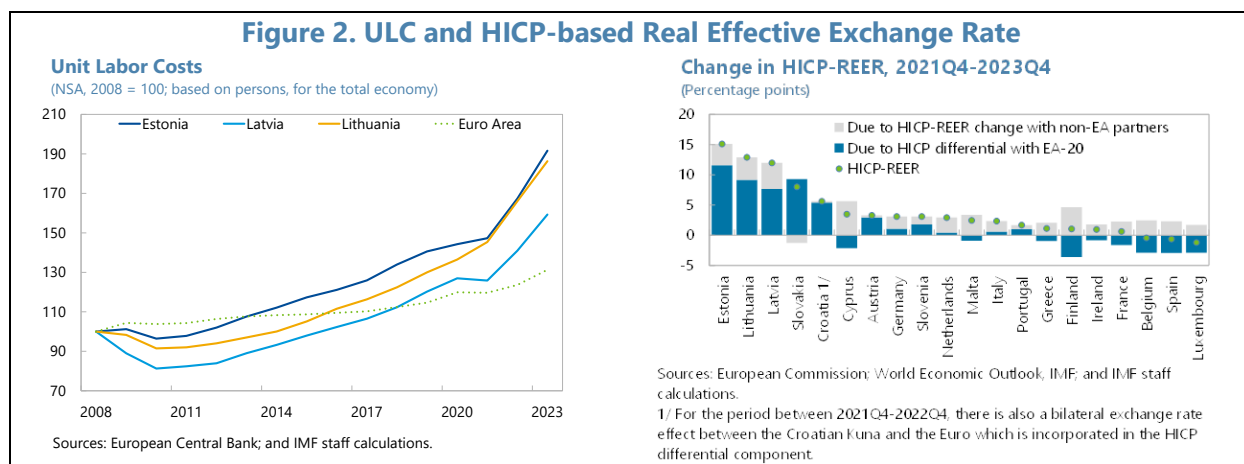
4.   A protracted fall in the trade share signals a persistent inability of Estonian exporters to keep up with competition in destination markets and may be a symptom of structural weaknesses. This paper delves into the factors that have contributed to Estonia's diminishing export share, aiming to quantify, to the extent possible, the impact of subdued productivity compared to competitors on the country's export performance. The most direct approach to addressing this question would be to calculate relative productivity measures for all Estonian export industries. However, detailed data for such comparisons are lacking on a comparable scale across countries. Thus, this paper follows a different approach, and uses constant share analysis (CSA) to break down and assess the impact of geographical and product concentration of external trade from competitiveness losses.

5.   The rest of the paper is structured as follows. Section B discusses the recent evolution of Estonia's export market share. Section C illustrates the methodology. Sections D to F assess the relative importance of structural versus cyclical factors in explaining Estonia's export performance, also in relation to the other Baltic countries. Section G makes some conjectures on the services export share. Section H concludes.

B.   The Decline in Estonia's Export Market Share

6.   We start our analysis by looking at the contributions by export destination to the overall change in Estonia's share of world merchandise exports. For convenience, we focus on Estonia's top ten export destinations, as well as a residual category including exports to the rest of

the world, which we further break down into EU and non-EU aggregates.[2] Since by construction the contributions across all countries and country groups must add up to the 23 percentage points decline observed in Estonia's export market share between 2021 Q3 and 2023 Q4, this measure provides a simple way of examining the distribution of the overall change across export destinations.

7.   The largest negative contributions to Estonia's export share decline came from the US, the Netherlands and Latvia (Figure 3). The negative contribution from the US is particularly noteworthy, as the country ranked only as the 10th largest destination of Estonia's exports in 2023 despite accounting for the largest contribution to the fall.[3] In contrast Sweden—one of Estonia's largest export destination absorbing 9 percent of its exports in 2023, and often mentioned as a key culprit for the fall in Estonia's exports—ranks only fourth on this measure. The role of Russia—not a key export market—was also limited.

Figure 3. Country Contribution to Export Share Decline and Main Export Destinations

Export Share Decline, 2021Q3-2023Q4
(Percentage points)

Contribution to Export Share Decline, 2021Q3-2023Q4
(Percentage points)

Source: Direction of Trade Statistics, IMF; and IMF staff calculations.

Sources: Direction of Trade Statistics, IMF; and IMF staff calculations.
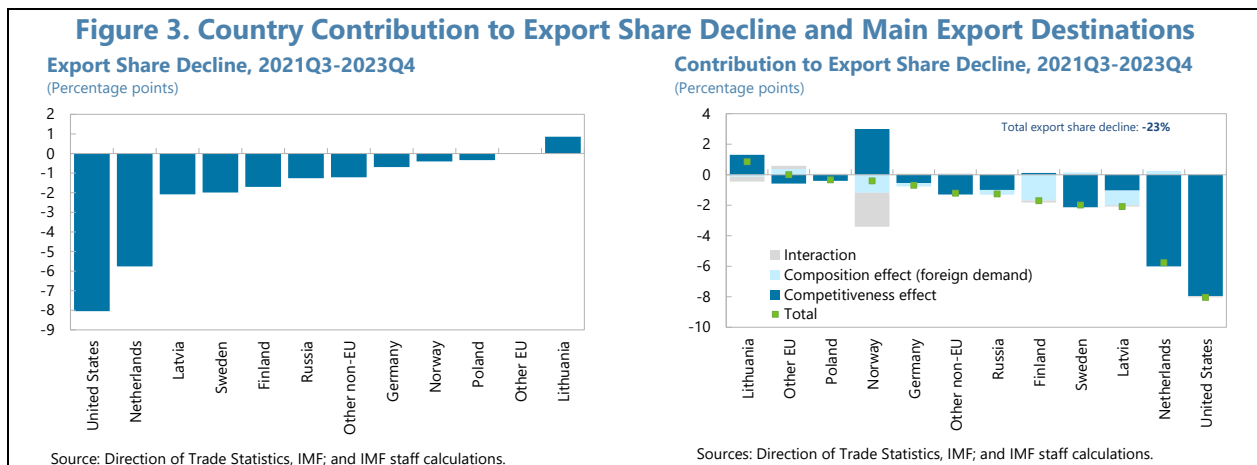
C. Methodology

8.   This section illustrates intuitively the constant share analysis (CSA) methodology. Following Gilbert (2017), let us consider the special case of an economy, r, that exports one product to one partner economy, p. Let total exports of the economy be X_r and total world exports be X_W. Then the economy's share of world exports is X_r/X_W. Letting X_{Wp} be world exports to country p, r's export market share can be rewritten as:

$$\frac{X_r}{X_W} = \frac{X_r}{X_{Wp}} \frac{X_{Wp}}{X_W}$$

---

[2] The top ten export destinations are based on export data as in 2023 Q3.

[3] The decline may reflect changes in supply chains of a limited number of large exporters, a phenomenon frequently observed in small open economies.

In words, the country's export share is equal to its share of world exports to country p multiplied by the share of p in world exports. Now, let:

$$\theta_r = X_r/X_W, \theta_{rp} = X_r/X_{Wp}, \text{ and } \delta_p = X_{Wp}/X_W.$$

Then, substituting, the expression becomes: $\theta_r = \theta_{rp} \times \delta_p$.

Let the change between any two periods be denoted by Δ, so $\Delta\theta_r$ is the change in the export share, and so on. Then, it must be the case that:[4]

$$\Delta\theta_r = \Delta\theta_{rp}\delta_p^0 + \Delta\delta_p\theta_{rp}^0 + \Delta\theta_{rp}\Delta\delta_p$$

where the shares δ and θ are evaluated at their initial values. This is the simplest version of the export market share growth decomposition.

9.   The economy in this simple example can increase its export market share by getting a larger share of its partner market, by having the partner market grow, or both. The decomposition allows to disentangle these effects. In particular, the expression shows that it is possible to decompose the change in the export market share into three components:

- **The first term is the effect on the share of expanding in the partner market, holding the size of the partner constant.** This intensive margin, or competitiveness effect, measures the portion of the change of r's export share that is attributable to a higher penetration of r's exports in the destination market, holding the size of the destination market constant; that is, it approximates the gains in r's export share that are attributable to competitiveness gains;

- **The second term is the effect of the growth in the size of the export partner, holding relative penetration constant.** This extensive margin, or composition effect, measures the portion of the change of r's export share that is attributable to the change in the size of the destination market. By weighing the change in the size of an export destination market in world trade by the average share of r's exports to that particular export destination, we are able to approximate what would have happened to the overall share had r's share remained constant and had only the size of the export market changed;

- **The third term is the interaction of the two effects above.**

10.   Gilbert (2017) provides an intuitive geometric exposition of the CSA breakdown. Essentially, the change in the export share is the area in red in Figure 4, which can be broken down in three areas representing the intensive and extensive margins and the interaction term. A more detailed description of the methodology and an example of how it is applied to measuring

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[4] To show this, let $z = xy$, then: $\Delta z = xy - x_0y_0$. Adding and subtracting xy_0: $\Delta z = xy + xy_0 - xy_0 - x_0y_0 = x\Delta y + y_0\Delta x$. Further adding and subtracting $x_0\Delta y$ yields: $\Delta z = x\Delta y + x_0\Delta y - x_0\Delta y + y_0\Delta x$. Factoring and rearranging yields: $\Delta z = x_0\Delta y + y_0\Delta x + \Delta x\Delta y$.

competitiveness is provided in di Mauro et al. (2005). Although the methodology is beset by several well-documented theoretical problems, it is informative for our purposes.[5]

11.   The formula can be generalized to more than a single export destination. It can also be extended to a detailed breakdown of export categories and goods. As we are mainly interested in the geographical dimension, in what follows we will mainly focus on the CSA for Estonia's exports by destination country, using detailed IMF Direction of Trade statistics. But we will also consider trade by sector in one case.

D.   CSA Decomposition: Estonia

12.   What explains Estonia's losses of export market share? Using constant share analysis, this section seeks to identify changes in Estonia's export market share that are related to the intensive margin, and hence to country's

Figure 4. CSA Decomposition

Source: Gilbert (2017).

competitiveness as discussed above, from those that reflect composition effects related to changes in the size of the destination markets.

13.   The decline in Estonia's export share has been largely driven by the intensive margin. Among the export destinations that contributed to the fall in Estonia's export market share between 2021 Q3 and 2023 Q4, a significant part of the decline was driven by the intensive margin, i.e., by the shrinking market share of Estonia's exports in those countries, which has to do with falling competitiveness (Figure 5). Only a small fraction of the share declines in a handful of countries (most notably, Finland, Latvia, and Norway) was due to the shrinking share of world trade claimed by those countries, i.e., composition effects or the extensive margin. In the case of Russia, the negative contributions from composition and competitiveness effects likely reflect, at least in part, the effects of the EU trade sanctions in response to Russia's invasion of Ukraine. According to this measure, therefore, Estonia has mostly lost ground to its competitors in certain export markets above and beyond what could have been explained by the individual dynamics in those markets.

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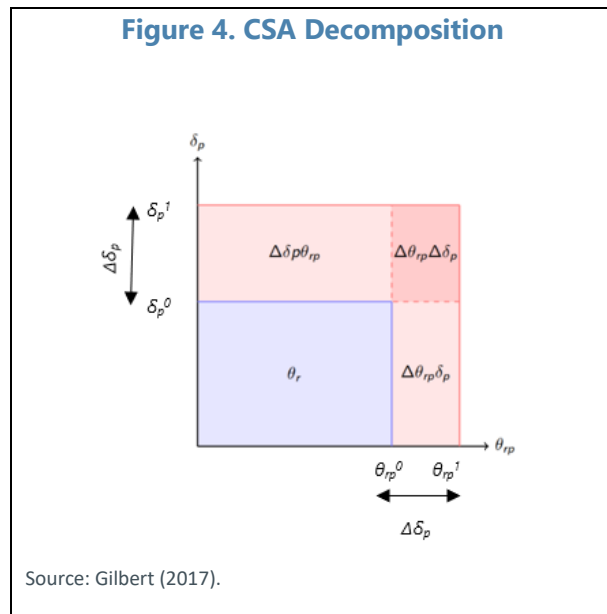
[5] Among the limitations, CSA assumes that the market structure remains unchanged over the analyzed period, ignoring the effects of technological advancements, changes in consumer preferences, and regulatory changes. It focuses on changes in market share attributable to internal factors such as price competitiveness and product quality, but it does not account for external factors, such as global economic conditions, exchange rate changes, and competitor actions. It assumes that products within the market are homogeneous, ignoring product differentiation, which can impact market share independently of price or volume changes. Finally, CSA provides information on changes in market share but does not offer insights into the underlying causes of those changes. Disentangling the effects of different factors influencing market dynamics requires additional analytical techniques or qualitative research. For a comprehensive discussion of these, and other, limitations of CSA, see Richardson (1971).

14.   We can use CSA to determine the drivers of the change in the export share over different time intervals. Over a longer-term perspective, the increase in Estonia's export market share during 2010 Q1-2011 Q1 was mainly attributable to a strong contribution from the intensive margin (Figure 5). The broadly flat export share between 2011 Q2 and 2021 Q2 was the result of a negative composition effect offsetting the positive contribution from competitiveness. However, an important caveat to this analysis is that the attribution becomes less precise the longer the time interval considered.

Figure 5. Contribution to Estonia's Export Share Decline

Contribution to Export Share Decline, 2021Q3-2023Q4 (Percentage points)

Contribution to Export Share Increase/Decline (Percentage points)

Sources: Direction of Trade Statistics, IMF; and IMF staff calculations.
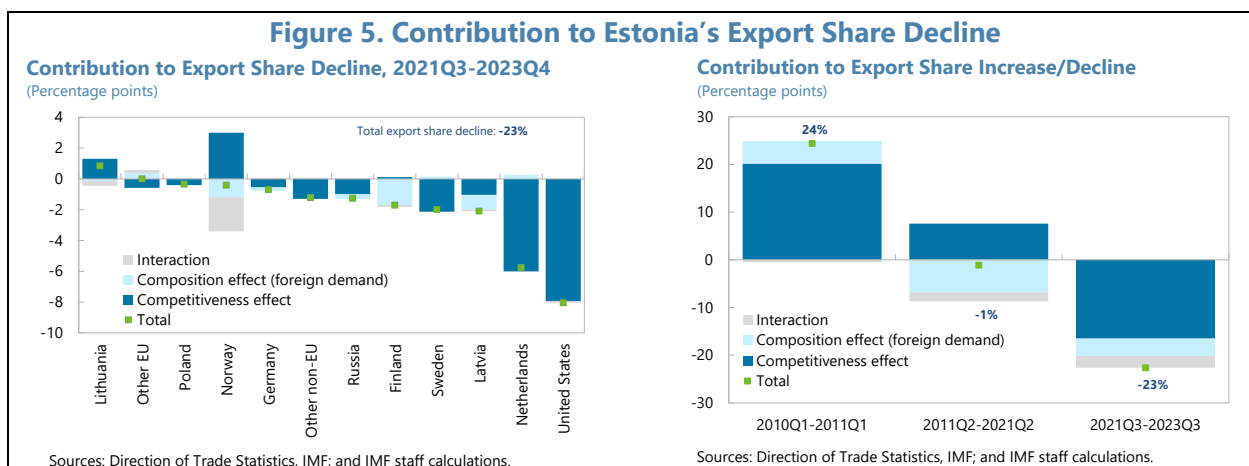
E.   CSA Decomposition: Comparison Across the Baltics

15.   A cross-country comparison using CSA shows losses of export shares for the Baltic region, but Estonia is worse off. During the post-Covid period, Latvia, and Lithuania also experienced losses of export shares, albeit less pronounced than in Estonia (by 6 percent and 7 percent, respectively, see Figure 6). A CSA decomposition applied to these countries shows that competitiveness issues (the intensive margin) played a much less prominent role overall. In Latvia, a large contribution to the fall came from the interaction term, which at the country-level was mainly associated with Russia. In Lithuania, the fall in the export share mainly reflected a large contribution from the extensive margin, and hence was mainly associated with shrinking foreign demand.[6]

Figure 6. CSA: Baltics Comparison

Contribution to Export Share Decline, 2021Q3-2023Q4 (Percentage points)

Sources: Direction of Trade Statistics, IMF; and IMF staff calculations.
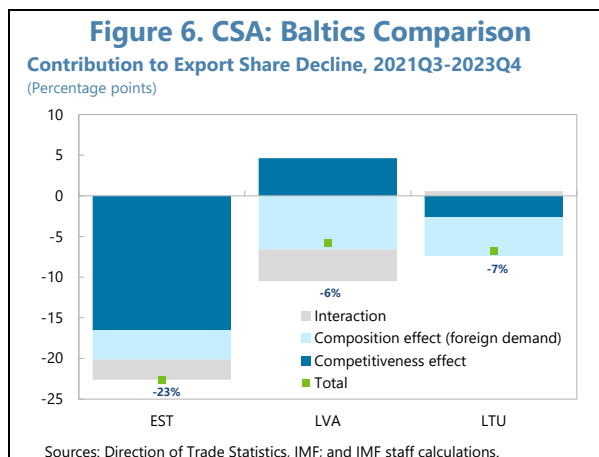
16.   Figure 7 shows the CSA breakdown for the three Baltic countries across different time periods. In the post-GFC period until 2011 (2010 Q1 and 2011 Q1), very large competitiveness gains underpinned the strong export market dynamics, particularly in Estonia and Lithuania. In the period

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[6] Annex Figure 1 shows the country contribution to the export share declines in Latvia and Lithuania.

between 2011 Q2 and 2021 Q2, strong export market dynamics continued to be mainly driven by competitiveness gains in Latvia and Lithuania, but the export share remained flat in Estonia.

Figure 7. CSA: Decomposition of Change in Export Market Shares in the Baltics
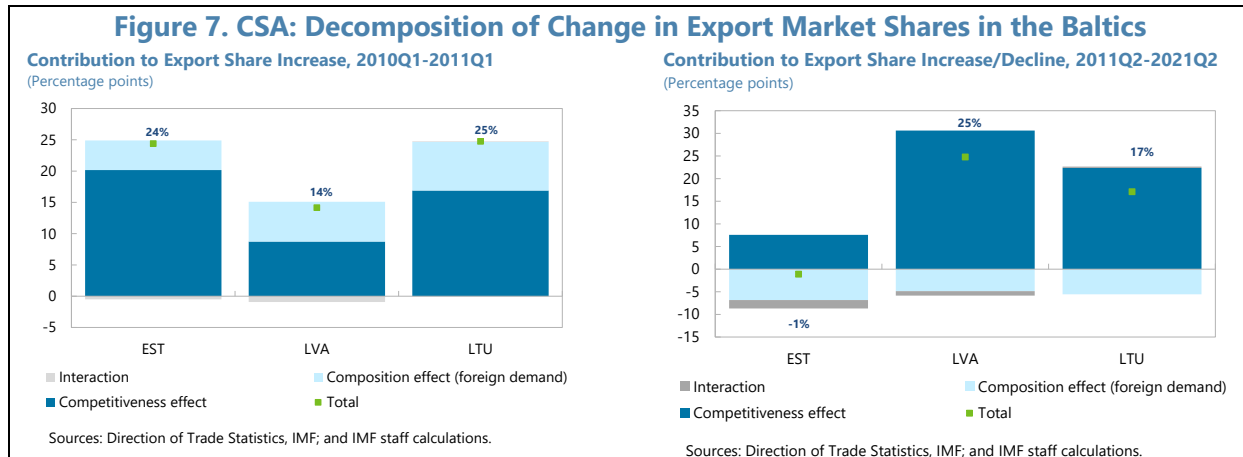
F. Sector Contributions to Export Performance

17.   The CSA methodology can also be applied to exports by product categories. For this decomposition, we follow Mandel (2012) who runs a similar analysis for the US, and use Eurostat's 2-digit harmonized system commodity data for each Baltic country.[7] Focusing on the top 10 commodity exports as in 2023Q3, Figure 8 shows that losses of export shares in Estonia are mainly due to the intensive margin and concentrate in mineral, wood, and machinery/electrical products. In Latvia, the picture is more mixed, with losses in some sectors partly offset by gains in others. Lithuania's small decrease in the export share mainly owes to the intensive margin.

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[7] We combine intra-EU and extra-EU exports to get total trade and re-group the 92 export categories in the database ('chapters') into the 21 'major sections' reported in the Harmonized System (HS) Nomenclature 2022 Edition, following the table developed by the World Customs Organization (WCO). To get world shares of each commodity, we use the CEPII database (see Gaulier and Zignago, 2010).

Figure 8. CSA: By Products

Estonia: Export Share Decline by Products, 2021Q3-2023Q4
(Percent)

Sources: Eurostat; CEPII; Direction of Trade Statistics, IMF; and IMF staff calculations.

Estonia: Contribution to Export Share Decline by Products, 2021Q3-2023Q4 (Percentage points)

Sources: Eurostat; CEPII; Direction of Trade Statistics, IMF; and IMF staff calculations.

Latvia: Contribution to Export Share Decline by Products, 2021Q3-2023Q4 (Percentage points)

Sources: Eurostat; CEPII; Direction of Trade Statistics, IMF; and IMF staff calculations.

Lithuania: Contribution to Export Share Decline by Products, 2021Q3-2023Q4 (Percentage points)

Sources: Eurostat; CEPII; Direction of Trade Statistics, IMF; and IMF staff calculations.

G.   The Services Export Share

18.   An argument could be made that Estonia's diminished role in merchandise trade could reflect a structural transformation with a shifting emphasis from export of goods to export of services. Underpinning this argument is the large contribution to the trade and current account balances from the net external balance in services and the relatively high and rising share of services in total gross value added, particularly the ICT sector (Figure 9).

Figure 9. Current Account Balance and Economic Structure

Current Account Balance
(Percent of GDP)

Sources: Eesti Pank; and IMF staff calculations.

Economic Structure, 2023
(Percent; measured as share of total real gross value added)

Sources: Eurostat; and IMF staff calculations.
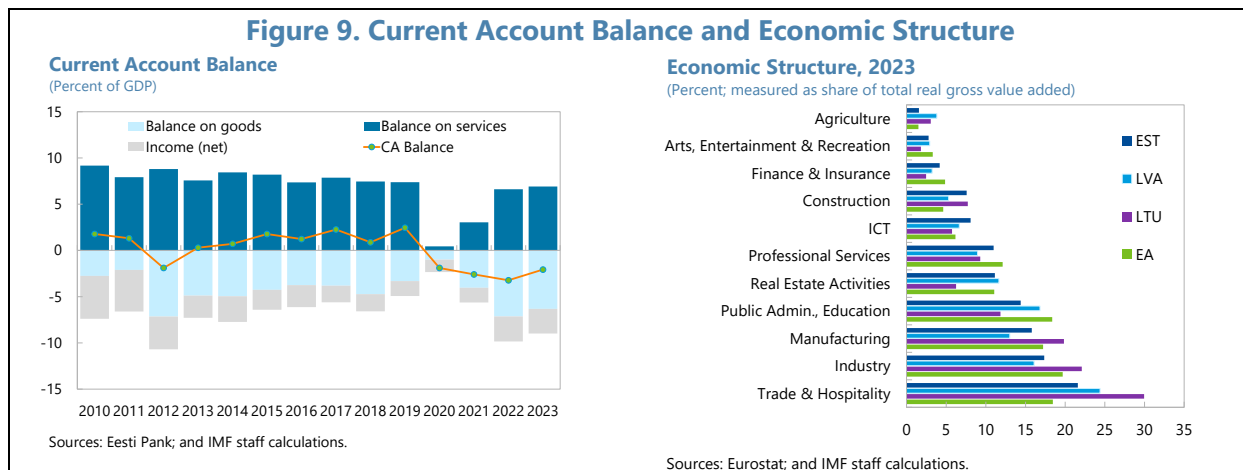
19. **The recent evolution of services exports relative to foreign demand offers little support for such an argument.** A CSA decomposition for the services export share, which would provide valuable evidence in support or confuting the prior above, cannot be performed due to lack of data. However, the Export Performance Index (EPI) shows that Estonia's services exports have increased by less than foreign demand since 2021, indicating that some loss of competitiveness has been recorded also in services (Figure 10).[8] Moreover, as services still account for only about a third of total exports, strong gains in services export shares would be required to fully offset the sharp falls in goods export shares to leave Estonia's total export of goods and services an unchanged share of total world exports.

Figure 10. Export Performance in Services

Export Performance Index: Services
(2010=100)

Sources: World Economic Outlook, IMF; European Central Bank; and IMF staff calculations.
*Data for 2023 is based on staff estimates.

Share of Goods and Services in Total Exports
(Percent)

Sources: Eesti Pank; Haver Analytics; and IMF staff calculations.
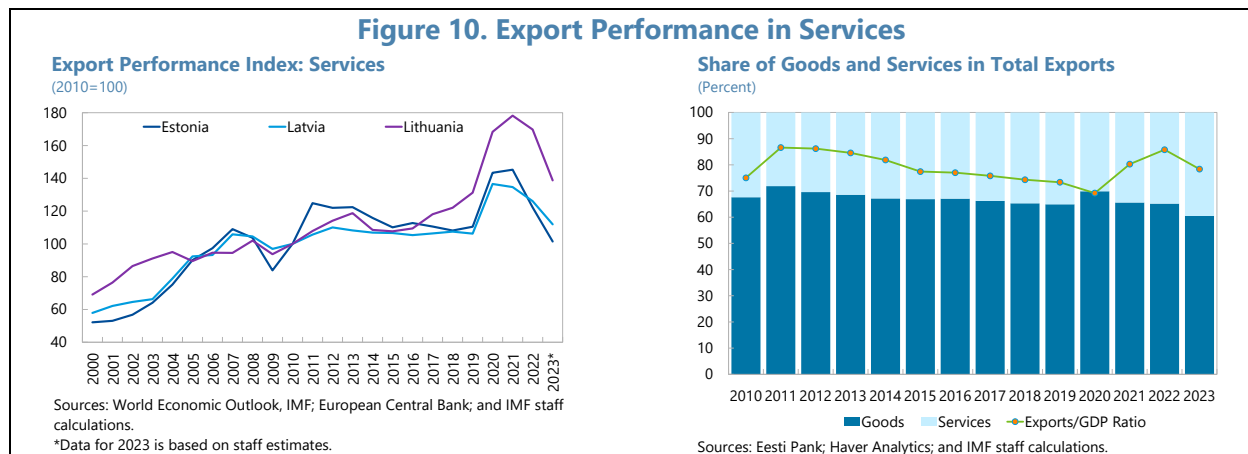
H. Conclusions

20. **Estonia's falling export market share indicates a persistent challenge for exporters in maintaining competitiveness against foreign counterparts.** While the immediate cause of the decline was the external shock stemming from Russia's war in Ukraine, faltering productivity and a progressive softening of external competitiveness resulting in a flat export market share have been evident since the global financial crisis, and thus predate the recent shocks.

21. **This paper finds that unlike in Latvia and Lithuania, the majority of Estonia's export market share decline can be attributed to the so-called 'intensive margin'.** This refers to the diminishing share of Estonia's exports in key destination markets, indicating a decline in external competitiveness and relative productivity. Services growth has also lagged foreign demand since 2021, suggesting emerging challenges in this segment of external trade as well.

22. **A few high-level policy implications can be drawn.** Addressing the erosion of external competitiveness will require structural reforms aimed at enhancing productivity, removing impediment to a structural transformation of the economy towards more technologically intensive and higher value-added products and services, as well as efforts to ensure that real wage growth

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[8] The Export Performance Index (EPI) is defined as the ratio between country *i*'s export volumes and its export demand, in turn defined as the weighted average of import volumes of country *i*'s trading partners using trade weights that reflect the relevance of the trading partner as a destination for country *i*'s exports.

remains closely aligned with productivity growth. By addressing these underlying challenges, Estonia can restore external competitiveness and ensure continued convergence towards the income levels of EU most advanced economies and Nordic neighbors.

Annex I. Additional Results

Annex I. Figure 1 shows the country contributions to the decline in the aggregate export market shares in Latvia and Lithuania. In Latvia, losses of export shares mainly reflected a strongly negative interaction term in Russia, likely reflecting the effects of the EU sanctions. In Lithuania, the small overall decrease in the export share was mainly driven by Russia.

Annex I. Figure 1. Contribution to Export Share Decline

Latvia: Contribution to Aggregate Export Share Decline, 2021Q3-2023Q4 (Percentage points)

Lithuania: Contribution to Export Share Decline in Goods, 2021Q3-2023Q4 (Percentage points)

Sources: Direction of Trade Statistics, IMF; and IMF staff calculations.
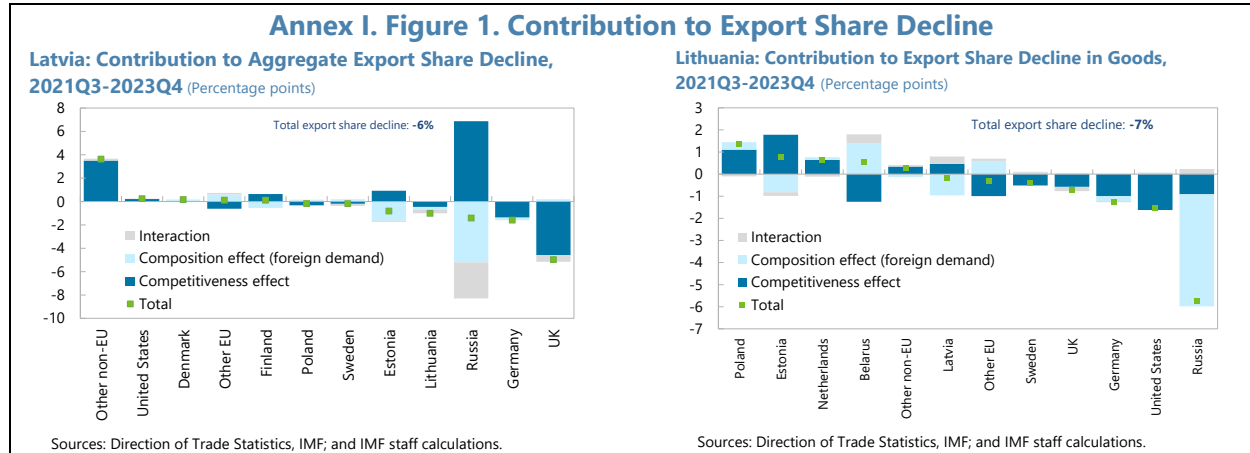
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TFP GROWTH, THE BALASSA-SAMUELSON HYPOTHESIS, AND COMPETITIVENESS IN THE BALTICS[1]

Kalman filter-based estimates suggest that potential GDP growth in Estonia has declined steadily since the Global Financial Crisis. To some extent, this is a common trend for the Baltic region. However, in Estonia this adjustment has been primarily driven by a fall in the growth of Total Factor Productivity. Falling TFP growth, combined with an appreciated real exchange rate, has likely reduced Estonia's ability to absorb recent shocks, taking a toll on its external performance and exacerbating its current economic downturn compared to other countries in the region.

A. Introduction

1.   Since regaining independence in the early nineties, Estonia experienced fast economic growth and convergence of per capita income towards more advanced countries in Europe. During the process, the real effective exchange rate (REER) was expected to appreciate reflecting faster total factor productivity (TFP) growth compared to trading partners (the Balassa-Samuelson effect).[2] A corollary of this proposition is that lagging productivity growth combined with continued REER appreciation can lead to loss of competitiveness.

2.   This Selected Issues Paper (SIP) provides estimates of TFP, assesses the Balassa-Samuelson hypothesis, and constructs a TFP-consistent REER for Estonia, which can be used as a benchmark for competitiveness. Estimates of TFP are obtained from a standard Cobb-Douglas production function applied to quarterly data of real GDP, labor, and capital inputs over the period from 1995Q1 to 2023Q2. The estimated TFP series is used to assess the Balassa-Samuelson hypothesis in a cointegrating equation with the REER.

3.   In the process, the SIP also provides estimates of the factors driving both actual and potential GDP. Signals from high-frequency indicators of economic slackness—confidence indices, industrial production, unemployment rate, and capacity utilization—are used in a multivariate Kalman filter to identify the business cycle and help estimate potential GDP. The same production function used to estimate TFP is applied to the filtered series (i.e., smooth trends) of the labor and capital inputs to decompose potential GDP. A structural (i.e., trend) TFP is estimated in the process. The decompositions of both actual and potential GDP distinguish between cyclical and "structural" (i.e., low frequency) drivers of real GDP over the sample period.

4.   The same methodology is extended to the other two Baltic countries, aiming at answering the following research questions. How has potential GDP evolved over the last three decades in the Baltics? What are the roles of the main production factors and TFP in driving the

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[1] Prepared by Carlos de Resende, Alice Fan, and Sadhna Naik.
[2] Balassa (1964) and Samuelson (1964).

dynamics of actual and potential GDP? Can the secular REER appreciation observed in the Baltics be fully accounted for by the TFP dynamics? Are there distinct paths of TFP and potential GDP growth among the three Baltic countries? Moreover, focusing on Estonia, can we disentangle the role played by both structural and cyclical factors during the recent economic downturn?

B.   Methodology

5.   **Step 1: Impose a standard Cobb-Douglas production function on quarterly data to estimate a series for TFP.** In particular, the TFP series is obtained as a residual from:

$$ln\ a_t = ln\ y_t - (1 - \alpha)\ ln\ k_t - \alpha\ ln\ l_t$$

where a_t, y_t, k_t and l_t are the levels of TFP, real GDP, the stock capital, and the labor input, respectively. Components y_t and k_t are both measured in millions of constant 2015 euros, while l_t is measured in thousands of hours-worked per quarter. The stock of capital was obtained by applying quarterly investment flows to data of the (annual) capital stock from the European Commission's Annual Macro-Economic Database (AMECO) and estimates of its depreciation rate. The resulting series (Figure 1) was then multiplied by a measure of industrial capacity utilization to produce an estimate of the *effective* capital stock, k_t. The labor input was constructed by multiplying the number of employees (e_t) by the average number of hours worked per employee (h_t). For the labor share, α_t, a smooth trend of the ratio of compensation of employes to GDP (i.e., the labor share) was used.[3]

6.   **Step 2: Apply a multivariate Kalman filter on quarterly real GDP data and indicators of economic slack**

Figure 1. Estimates of TFP
(In logarithmic form)

Sources: Statistics Estonia; Eurostat; Haver Analytics; and IMF staff calculations.

Figure 2. Estimates of Structural TFP
(In logarithmic form)

Sources: Statistics Estonia; Eurostat; Haver Analytics; and IMF staff calculations.

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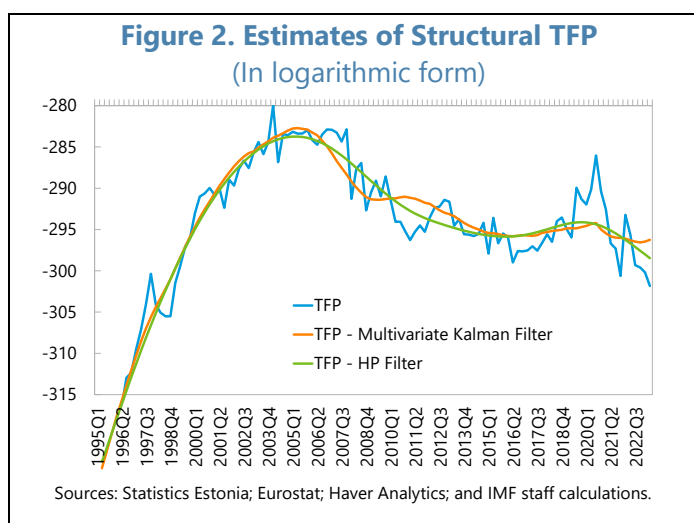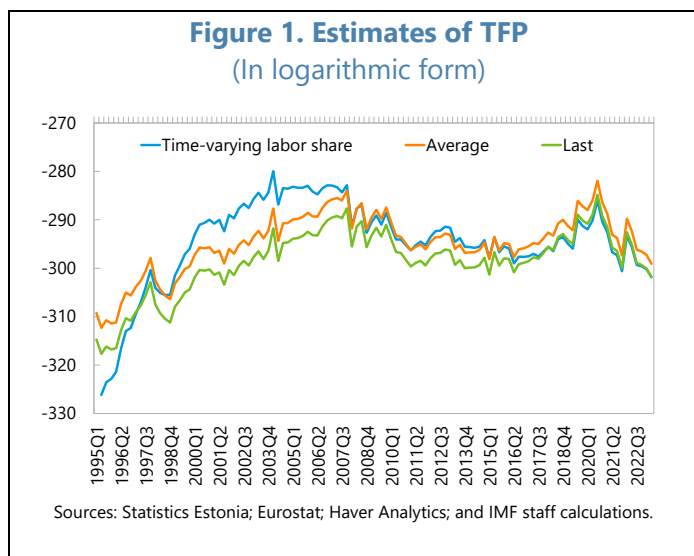
[3] For Estonia, α_t is relatively stable and mean-reverting but it has been increasing markedly in both Latvia and Lithuania since around 2015. For that reason, in the estimation of total factor productivity, instead of a fixed calibrated value for α (e.g., at its historical average or last observed value) a smooth, time-varying labor share was used for the three countries.

to estimate potential GDP. The TFP series obtained in step 1 captures the effect of both cyclical (reflecting, for example, short-term developments such as labor hoarding, short-term skills mismatch etc.) and structural (i.e., low-frequency effects of institutions, business environment and practices, education, R&D etc.) elements that are not explained by labor and capital. To isolate the structural component of TFP, an estimate of potential GDP ($\bar{y}_t$) was independently obtained from a state-space decomposition of cycle and trend in GDP using monthly confidence indices (i.e., consumer, industry, construction, and retail sector), the unemployment rate, and industrial capacity utilization as signal variables to help pin down the cyclical components.[4] A trend TFP series (Figure 2), $\bar{a}_t$, was obtained from the production function equation applied to HP-filter trends for effective capital ($\bar{k}_t$), employment ($\bar{e}_t$), and hours-worked ($\bar{h}_t$). For comparison, Figure 2 also displays the HP-trend of the estimated TFP series.

7.   **Step 3: Estimate a cointegration relationship between the TFP and the REER to assess the Balassa-Samuelson Hypothesis.** After confirming that both series are integrated,[5] Johansen cointegration tests found at least one cointegrating relationship between the two variables according to different specifications regarding exogenous regressors in the cointegration vector and/or short-term dynamic equations (Table 1). This result, confirmed for all three Baltic countries, is consistent with the Balassa-Samuelson hypothesis, indicating a long-run relationship between TFP and REER. It also indicates that a cointegration relationship between TFP and the REER can be estimated (Table 2), and the fitted values can be used to construct a measure of the TFP-based REER as the implied long-term relationship between the two series. The comparison between actual and TFP-based REER can indicate how large deviations from the Balassa-Samuelson hypothesis are. Such deviations have implications for competitiveness. For instance, negative (positive) gaps between actual and TFP-based REER indicate a price-competitiveness advantage (disadvantage).

Table 1. Estonia: Johansen Cointegration Tests

Sample (adjusted): 1995Q4 2023Q2
Number of observations: 111
Endogenous variables: **_ln_ (TFP) _ln_ (REER)**

Rank Selection by Test and Deterministic Case

| | Deterministic Case | | | | | | | |
Test Type	Case 1	Case 2	Case 3 JHJ	Case 3	Case 4 JHJ	Case 4	Case 5 JHJ	Case 5
Trace	1	1	1	1	1	1	2	2
Max-Eigen	1	1	1	1	1	1	2	2

Note: Rank selected at 0.05 level using critical values from MacKinnon-Haug-Michelis (1999)

Remarks: *Case 1*: No deterministic terms; *Case 2*: Cointegrating relationship includes a constant; *Case 3* (Johansen-Hendry-Juselius): Cointegrating relationship includes a constant. Short-run dynamics include a constant; *Case 3*: Short-run dynamics include a constant; *Case 4* (Johansen-Hendry-Juselius): Cointegrating relationship includes a constant and trend. Short-run dynamics include a constant; *Case 4*: Cointegrating relationship includes a trend. Short-run dynamics include a constant; *Case 5* (Johansen-Hendry-Juselius): Both the cointegrating relationship and short-run dynamics include a constant and trend; *Case 5*: Short-run dynamics include a constant and trend.

Source: IMF staff estimates

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[4] Blagrave et. al. (2015), Benes and N'Diaye (2004), and IMF (2017).
[5] Using Augmented Dickey-Fuller tests with a test specification that includes both a constant and a deterministic linear trend, with lags selected automatically based on Schwartz information criteria.

Table 2. Estonia: Cointegration Between REER and TFP

Dependent Variable: Ln (REER)
Method: Dynamic Least Squares (DOLS)
Sample (adjusted): 1996Q4 2023Q2
Included observations: 107 after adjustments
Cointegrating equation deterministic factors: C @TREND
Automatic leads and lags specification (lead=0 and lag=6 based on SIC criterion.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Ln (TFP)	0.474694	0.099533	4.769219	0.0000
C	117.8676	29.78622	3.957117	0.0001
@TREND	0.318322	0.016930	18.80248	0.0000
R-squared	0.963722	Mean dependent var		-3.059513
Adjusted R-squared	0.960356	S.D. dependent var		12.44653
S.E. of regression	2.478203	Sum squared resid		595.7244
Long-run variance	18.70264			

Source: IMF staff estimates

C. Results

Potential GDP Growth Has Declined Since the GFC, Driven by a Fall in TFP Growth

8.   Estimates of potential GDP levels point to scarring effects. Simple extrapolations in Figure 3 suggest significant output losses following the GFC and, to a lesser extent, the pandemic. The latter may be related to supply chain disruptions and labor hysteresis which started with the pandemic and were compounded by Russia's war on Ukraine.

9.   Potential GDP growth has declined steadily since the GFC. Figure 4 shows that potential growth fell from above 5 percent pre-GFC period to around 2 percent post-GFC. Actual growth has dropped even lower after 2020 and well below potential growth, suggesting also a significant cyclical component in the current downturn.

Figure 3. GDP
(Mil. Euros)

Source: Statistics Estonia; and IMF staff calculations.

10.   Capital has been *the* major driver of GDP growth in Estonia. Figure 4 also shows the contributions to GDP of TFP, capital, labor, and the change in the time-varying labor share for the three different periods. After acting as a drag on GDP growth in the pre-GFC period, labor has supported growth in the following periods. However, the contribution of labor has remained less significant than that of capital even in recent years, despite the large migration flows following Russia's war on Ukraine.
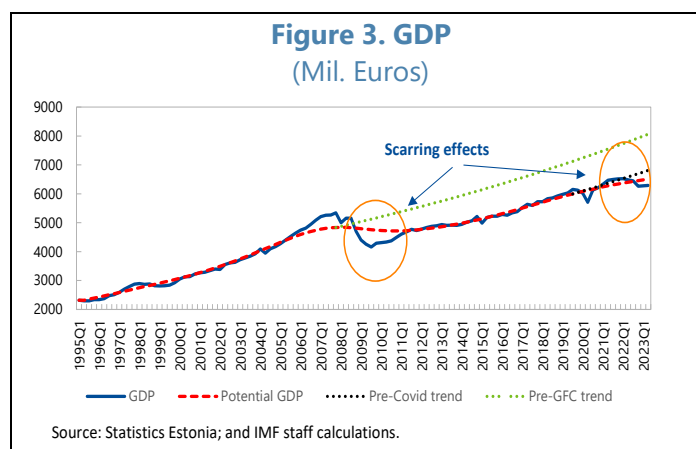
11. **The fall in TFP growth accounts for most of the decline in GDP growth.** After providing a significant contribution to GDP growth in the pre-GFC period, TFP growth faded post GFC and has turned *negative* more recently. When comparing the years after 2020 with the pre-GFC period, the decline in average TFP growth surpasses that of actual GDP growth and explains almost 90 percent of the fall in estimated potential GDP growth (Table 3). The fall in TFP growth is also significant relative to the post-GFC period, and explains the current downturn, while the contribution of both capital and labor to GDP growth has increased (Table 4).

Figure 4. Decomposition of Actual and Potential GDP Growth
(Percentage points per year)

Source: Statistics Estonia; Eurostat; Haver Analytics; and IMF staff calculations.
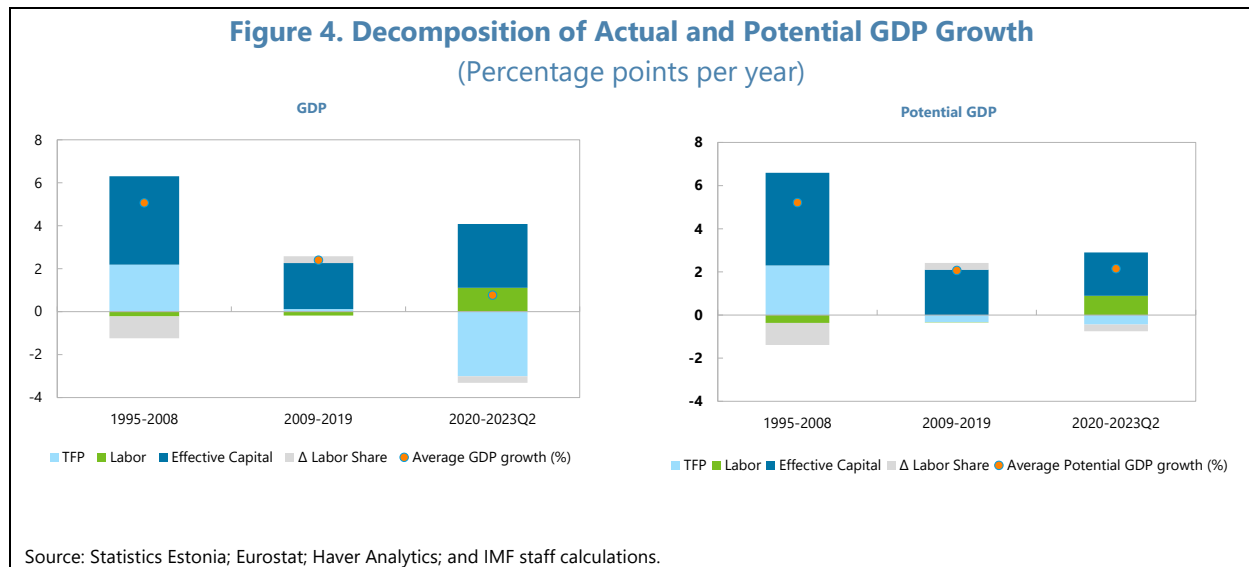
12. **Capital and labor have dampened the fall in growth in the recent downturn.** Table 4 offers a more granular breakdown of the various components, including the specific drivers of capital and labor, shedding more light on the current downturn. Capital accumulation and capacity utilization have both cushioned the decline in GDP growth after 2020, although capacity utilization remains on a downward trend. While demographics, labor participation and hours-worked have all contributed positively to GDP growth recently, the structural contribution of the unemployment rate has turned negative, suggesting an increase in the natural rate of unemployment.

Table 3. Estonia: Changes in GDP Growth Rates Between 1995-2008 and 2020-2023Q2
(Percentage points)

	Total	Trend	Cyclical
GDP	-4.3	-3.1	-1.2
TFP	-5.2	-2.7	-2.5
K	-1.1	-2.3	1.1
L	1.3	1.3	0.1
Δα	0.7	0.7	0.0

Source: IMF staff estimates

Table 4. Estonia: Decomposition of GDP Growth (Percentage points)								
	1995-2008			2009-2019			2020-2023Q2		
	Total	Structural	Cyclical	Total	Structural	Cyclical	Total	Structural	Cyclical
TFP	30.7	32.2	-1.6	1.4	-3.6	5.0	-10.5	-1.6	-9.0
Capital	57.6	60.2	-2.6	23.5	23.1	0.4	10.4	7.0	3.3
Capital accumulation	47.9	47.9	n.a	20.8	20.8	n.a	8.4	8.4	n.a
Capacity utiization	9.7	12.3	-2.6	2.7	2.3	0.4	2.0	-1.4	3.3
Labor	-3.1	-5.2	2.1	-2.0	-0.1	-1.8	3.9	3.1	0.8
Labor force	-0.3	-1.6	1.2	0.3	1.6	-1.4	2.8	2.2	0.6
(-) Unemployment	0.8	0.2	0.6	1.6	1.5	0.1	-1.0	-0.3	-0.7
Hours-worked	-3.6	-3.8	0.2	-3.9	-3.3	-0.6	2.1	1.2	0.8
Net L/K Share Shift	-14.2	-14.2	0.0	3.5	3.4	0.1	-1.1	-1.1	0.0
GDP	70.9	73.0	-2.1	26.4	22.7	3.6	2.7	7.5	-4.8
Average Annual Growth	5.1	5.2	-0.1	2.4	2.1	0.3	0.8	2.2	-1.4
TFP	2.2	2.3	-0.1	0.1	-0.3	0.5	-3.0	-0.4	-2.6
Capital	4.1	4.3	-0.2	2.1	2.1	0.0	3.0	2.0	1.0
Labor	-0.2	-0.4	0.1	-0.2	0.0	-0.2	1.1	0.9	0.2
Δ Labor Share	-1.0	-1.0	0.0	0.3	0.3	0.0	-0.3	-0.3	0.0

Source: IMF staff estimates
Note: growth rates calculated as difference in natural logarithms of original series.

Declining TFP Growth Has Compounded with Real Exchange Rate Appreciation in the Current Downturn

13.   Fast TFP growth pre- GFC gave Estonia a competitive edge. Figure 5 shows that before the GFC actual REER was below the TFP-based REER (i.e., negative REER gaps) most of the time, indicating that the REER was undervalued relative to the (counterfactual) TFP-based equilibrium REER, providing Estonia with a price-competitiveness edge.

14.   But Estonia's competitive advantage was significantly eroded after the GFC. After 2008, periods of negative REER gaps gave way to periods of positive gaps. Negative REER gaps became

Figure 5. REER and TFP-Based REER
(LHS – in logarithmic form; RHS – in percent)

Source: Statistics Estonia; Eurostat; Haver Analytics; and IMF staff calculations.

significantly smaller and shorter-lived, while the positive gaps were larger and more frequent
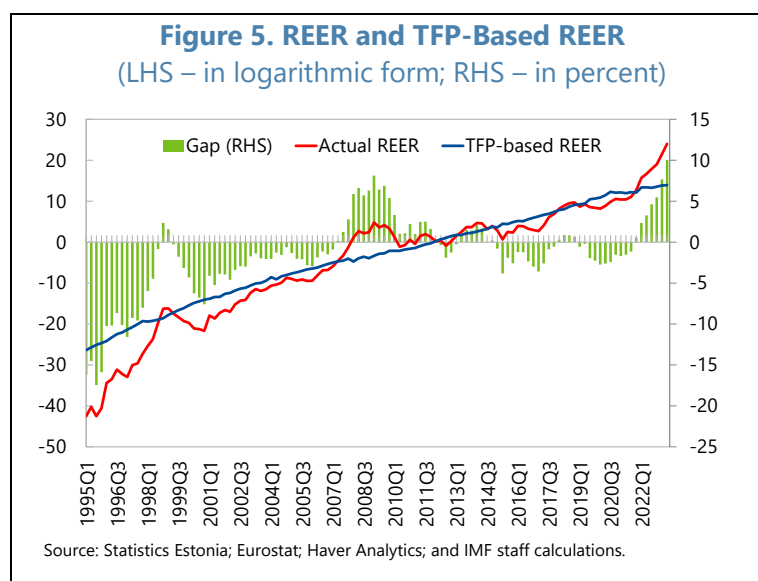
relative to the previous period (Figure 5), indicating some erosion of competitiveness during a phase of declining GDP growth.

15.   The current downturn has coincided with both sharp real exchange rate appreciation and a decline in TFP, exacerbating existing problems. A significant divergence between actual and TFP-based REER has started in late 2021, at the onset of the current downturn, as steady TFP deceleration turned into a decline and compounded with real exchange rate appreciation. The overvalued exchange rate has likely reduced Estonia's ability to absorb recent shocks, leading to a decline in net exports and economic activity.

Figure 6. Contribution to GDP Growth in the Baltics 1/
(Percentage points per year)

Source: IMF staff calculations.
1/ Growth rates calculated as difference in natural logarithims of original series.
2/ Latvia: 2002Q2-2008; Lithuania: 1998Q3-2008
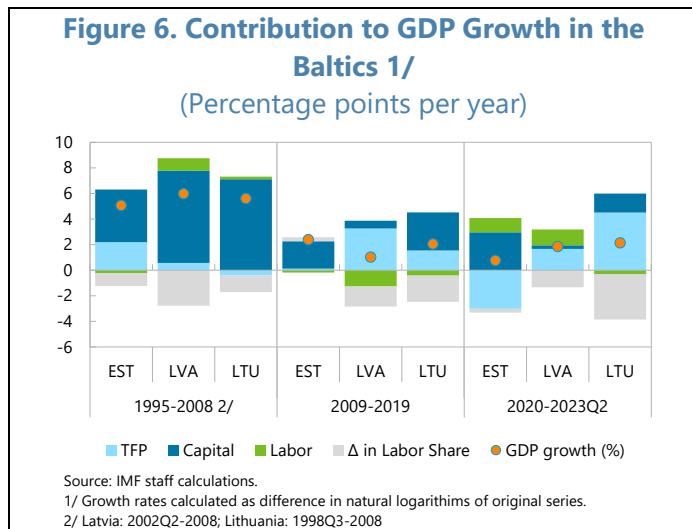
The Interplay Between TFP Growth and the Real Exchange Rate May Explain Some Regional Differences

16.   Capital accumulation drove the Baltics' convergence process. Figure 6 shows the factors driving GDP growth across the three Baltics. Prior to the GFC, all three countries experienced rapid GDP growth, mainly driven by capital accumulation. This is typical of a period of capital deepening and fast income convergence.

17.   After 2008, TFP growth diverged across the Baltics. Post-GFC the capital contribution to GDP growth has declined, especially for Latvia. In contrast, our analysis suggests that TFP has increasingly become a driver of growth for Latvia and especially Lithuania. Estonia has been the exception with declining and eventually negative productivity growth, as discussed in the previous section. Differences in TFP dynamics may be at the root of Estonia's underperformance after 2021.

18.   Diverging cyclical and structural forces are also behind recent regional developments. A more granular decomposition of the drivers of GDP growth between structural and cyclical components offers shed more light on recent developments in the region (Figure 7). While cyclical components appear to be playing an important role for Latvia and Estonia—in this case especially TFP—Lithuania's expansion is largely driven by a structural contribution of TFP and, to a lesser extent, capital.

19.   Similar to Estonia, Latvia appears to have had a competitive edge that faded post-GFC. Figure 8 shows actual and estimated TFP-based REER for the Baltics. Prior to the GFC, high TFP relative to REER explained consistently negative REER gaps for Estonia and Latvia. In Estonia, negative REER gaps were largely driven by high TFP, whereas in Latvia a depreciating real exchange rate was the main factor. In Lithuania, the gap turned negative only in 2005-2007 and to a smaller

extent. As a result, Latvia and Estonia likely experienced competitiveness advantages during this period, while Lithuania did not. However, post-GFC this advantage faded. Declining productivity growth in the case of Estonia and real exchange rate appreciation for Latvia drove REER gaps into positive territory.

Figure 7. Contribution to GDP Growth in the Baltics, 1995–2023

Source: Statistical Authorities; Eurostat; Haver Analytics; and IMF staff calculations.
Note: Growth rates are the difference in natural logarithms. Latvia: 2022Q2-2023Q2; Lithuania: 1998Q3-2023Q2

Figure 8. Actual and TFP-Based REER in the Baltics, 1995–2023[1]
(LHS - natural logs; RHS - percent)

Source: IMF staff estimates
[1] Latvia: 2002Q2-2023Q2; Lithuania: 1998Q3-2023Q2.

20. Estonia's TFP-based competitive disadvantage observed more recently started earlier and became stronger than in Latvia and Lithuania. Figure 8 shows a decoupling between actual and TFP-based REER in recent years for all three Baltic countries. The REER gap is larger for Estonia, which is consistent with the country's underperformance. Figure 9 zooms in the REER gaps during this period. The competitiveness disadvantage has started earlier for Estonia, and it has been more pronounced.

Figure 9. REER Gaps in the Baltics
(Percent)

Source: Statistical Authorities; Haver Analytics; and IMF staff calculations.
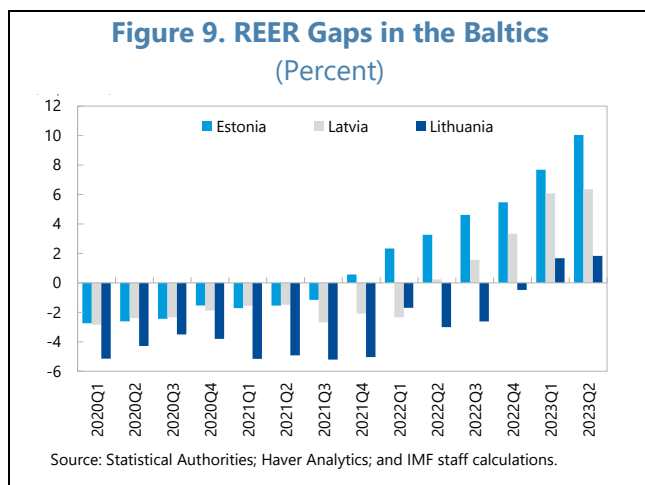
D. Conclusions

21. **Potential GDP growth in Estonia has fallen since the GFC, largely due to a steady decline in TFP growth.** Some decline in potential GDP growth typically accompanies the process of income convergence, as capital accumulation decelerates. However, the largest contributor to the reduction in potential GDP growth for Estonia has been a decline in TFP growth. And the drop in TFP growth has been significantly more pronounced than in Latvia and, especially, Lithuania, which appears to experience an acceleration in TFP growth in recent years.

22. **Differently from Latvia and Lithuania, the level of TFP has declined in Estonia since 2020.** Not only has TFP growth declined in Estonia since the GFC, but it has become negative more recently. The decline in TFP growth has a structural component, which is probably associated with the scarring effects of recent shocks.

23. **Differences in TFP dynamics across the Baltic countries have implications for competitiveness.** Pre-GFC, fast TFP growth underpinned Estonia's competitive advantage, despite real exchange rate appreciation. Post-GFC, decelerating TFP growth has eroded Estonia's competitive advantage. More recently, significant real exchange rate appreciation has compounded the effect of declining TFP, turning into a competitive disadvantage and left the country more vulnerable to recent shocks. Loss of competitiveness may be a factor in Estonia's current, more severe economic downturn relative to other Baltic countries. In Estonia, the (positive) wedge between the actual and TFP-based REER started earlier, evolved faster, and became wider than in the other Baltics, reducing the country's external competitiveness by a much larger factor than in Latvia and Lithuania.

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THE ROLE OF ALLOCATIVE EFFICIENCY IN PRODUCTIVITY GROWTH[1]

Resource misallocation has dragged down total factor productivity growth in all three Baltic economies. In the case of Estonia, allocative efficiency improved after the global financial crisis, but the recovery was limited and short-lived. Productivity loss due to resource misallocation is more pronounced for services than goods sectors. For some Estonian industries such as mining and real estate, allocative inefficiency has worsened more significantly. Structural reforms in product, capital and labor markets can help improve allocative efficiency, and therefore promote productivity growth and contribute to restoring competitiveness for Estonia.

A.   Introduction

1.   Allocative efficiency has declined in Estonia and in the Baltic region. Resource allocation is an important factor underpinning economic growth. In an ideal world, resources flow to where productivity is the highest until the marginal return of an input is equalized across firms and sectors. In this paper, we explore the role of allocative efficiency in promoting total factor productivity growth and supporting competitiveness, using firm-level data for the Baltics[2] and following the methodology of Hsieh and Klenow (2009) and the IMF World Economic Outlook (April 2024). Intuitively, allocative efficiency is measured as the wedge between total factor productivity in an ideal case scenario and an alternative scenario with distortions in capital, labor, and output markets. It is reflected in the dispersion of marginal revenue products of capital and labor, in other words the marginal revenue generated by one additional unit of these production factors. Our study finds that allocative efficiency has worsened generally in all three Baltics, with a limited and short-lived recovery in Estonia after the global financial crisis (Figure 1).

Figure 1. Allocative Efficiency Has Worsened in the Baltics in General

Estonia: Allocative Efficiency (Natural log)

Sources: Orbis, IMF staff calculations.

Latvia: Allocative Efficiency (Natural log)

Sources: Orbis, IMF staff calculations.

Lithuania: Allocative Efficiency (Natural log)

Sources: Statistics Lithuania, IMF staff calculations.

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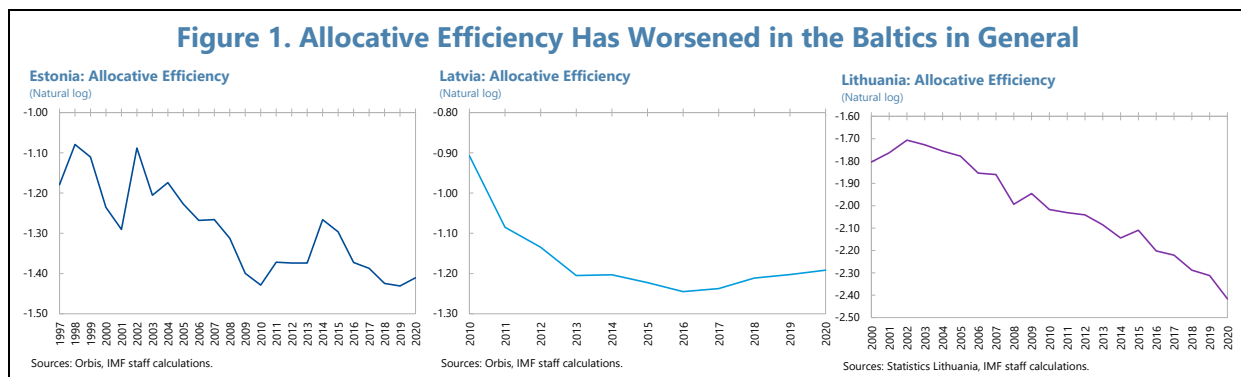
[1] Prepared by Bingjie Hu and Can Ugur.

[2] For Estonia and Latvia, we use the Orbis dataset. For Lithuania, we use the administrative data from Statistics Lithuania. In our upcoming working paper, we plan to update our exercise using the confidential administrative data from Statistics Estonia and Latvia Central Statistics Bureau.

2.   Most of the allocative inefficiency accumulated before the global financial crisis. In the years leading up to the financial crisis, some countries, including Estonia, experienced real estate bubbles characterized by rapidly rising property prices and speculative investment. Resources were disproportionately allocated to the construction and real estate sectors, leading to misallocation of capital, which impacted allocative efficiency. This expansion led to excessive borrowing and investment in sectors with lower productivity or unsustainable projects, resulting in misallocation of resources, and thereby worsening allocative efficiency. Government policies, such as subsidies, tax incentives, or regulatory frameworks, may have also adversely influenced the allocation of resources in the economy.

B. Methodology: How We Derive Allocative Efficiency

3.   We calculate a measure of allocative efficiency using firm-level data. Following Hsieh and Klenow (2009) and IMF (2024), we introduce the following assumptions.

1) A Cobb-Douglas production function at the firm level: where α_{cs} represents the country-sector specific capital share. Y_{csit}, A_{csit}, K_{csit}, and L_{csit} represent output, technology, capital, and labor at the firm level. The subscripts *c, s, i,* and *t* represent country, sector, firm, and year, respectively.

$$Y_{csit} = A_{csit} K_{csit}^{\alpha_{cs}} L_{csit}^{1-\alpha_{cs}} \tag{1}$$

2) Aggregation with constant elasticity of substitution: where σ_c represents the elasticity of substitution. Lower case *i* indicates sector *i*.

$$Y_{cst} = \left(\sum_{i=1}^{I_{cst}} Y_{csit}^{\frac{\sigma_c-1}{\sigma_c}} \right)^{\frac{\sigma_c}{\sigma_c-1}} \tag{2}$$

3) Distortions on output, capital, and labor markets: the distortions on capital and labor markets increase the effective cost of capital and labor by τ_K and τ_L, respectively. τ_Y represents a tax on output. τ_{csit} is defined as a function of the distortions on capital, labor, and output markets.

$$\tau_{csit} \equiv (1 + \tau_{Kcsit})^{\alpha_{cs}} (1 + \tau_{Lcsit})^{1-\alpha_{cs}} / (1 - \tau_{Ycsit}) \tag{3}$$

4) Taking prices P_{csit} as given, firms maximize profits under monopolistic competition, by choosing the optimal amount of capital (*K*) and labor (*L*) such that the marginal revenue product of each input factor is equal to its marginal cost, as described by Equations (4) and (5). r_{cst} and w_{cst} are the cost of capital and labor, respectively, at the sector level.

$$K_{cst} = \frac{\alpha_{cs}}{r_{cst}} \frac{\sigma_c - 1}{\sigma_c} \sum_{i=1}^{I_{cst}} \frac{(1 - \tau_{Ycsit}) P_{csit} Y_{csit}}{1 + \tau_{Kcsit}}, \tag{4}$$

$$L_{cst} = \frac{1 - \alpha_{cs}}{w_{cst}} \frac{\sigma_c - 1}{\sigma_c} \sum_{i=1}^{I_{cst}} \frac{(1 - \tau_{Ycsit}) P_{csit} Y_{csit}}{1 + \tau_{Lcsit}}, \tag{5}$$

Equation (6) gives the output in the equilibrium. As illustrated by equation (7), the marginal revenue product of capital and labor, will not be equalized due to the distortions.

$$Y_{cst} = \frac{\left(\frac{A_{csit}}{\tau_{csit}}\right)^{\sigma_c} K_{cst}^{\alpha_{cs}} L_{cst}^{1-\alpha_{cs}}}{\left[\sum_{i=1}^{I_{cst}} \left(\frac{A_{csit}}{\tau_{csit}}\right)^{\sigma_c-1} \frac{1-\tau_{Ycsit}}{1+\tau_{Kcsit}}\right]^{\alpha_{cs}} \left[\sum_{i=1}^{I_{cst}} \left(\frac{A_{csit}}{\tau_{csit}}\right)^{\sigma_c-1} \frac{1-\tau_{Ycsit}}{1+\tau_{Lcsit}}\right]^{1-\alpha_{cs}}} \tag{6}$$

$$\frac{MRPK_{csit}}{r_{cst}} = \frac{1+\tau_{Kcsit}}{1-\tau_{Ycsit}}, \qquad \frac{MRPL_{csit}}{w_{cst}} = \frac{1+\tau_{Lcsit}}{1-\tau_{Ycsit}} \tag{7}$$

5) Equations (8) and (9) illustrate the fact that in an ideal world without distortions, total factor productivity at the sector level is an aggregation of the technology component of the firm-level productivity *A*, since the distortion parameters τ_{csit} and τ_{cst} both equal 1 in that case. With distortions on factor and output markets, total factor productivity becomes lower than that in the ideal-case scenario. This wedge is represented by the term AE in Equation (10). For each unit decline in allocative efficiency, there will be a one-percentage point decline in TFP growth.

$$TFP_{cst} \equiv \left[\sum_{i=1}^{I_{cst}} A_{csit}^{\sigma_c-1} \left(\frac{\tau_{csit}}{\tau_{cst}}\right)^{1-\sigma_c}\right]^{\frac{1}{\sigma_c-1}} \tag{8}$$

$$Y_{cst} = TFP_{cst} K_{cst}^{\alpha_s} L_{cst}^{1-\alpha_s} \tag{9}$$

$$\ln TFP_{ct} = \sum_{s=1}^{S} \theta_{cst} \ln \left[k_{cst}^{\alpha_{cs}} l_{cst}^{1-\alpha_{cs}} \underbrace{\left(\sum_{i=1}^{I_{cst}} A_{csit}^{\sigma_c-1}\right)^{\frac{1}{\sigma_c-1}}}_{\equiv A_{cst}^*} \right]$$
$$+ \sum_{s=1}^{S} \theta_{cst} \ln \underbrace{\left[\sum_{i=1}^{I_{cst}} \frac{A_{csit}^{\sigma_c-1}}{\sum_{i=1}^{I_{cst}} A_{csit}^{\sigma_c-1}} \left(\frac{\tau_{csit}}{\tau_{cst}}\right)^{1-\sigma_c}\right]^{\frac{1}{\sigma_c-1}}}_{AE_{cst}} \tag{10}$$

C. Decomposition of TFP Growth

4.   Our decomposition exercise shows that allocative inefficiency has negatively contributed to TFP growth. We first aggregate the calculated allocative efficiency up to the sector level, and then decompose country level TFP growth into innovation and allocative efficiency component of total factor productivity growth. The two components are captured by the two terms on the right-hand side of Equation (11). Our results show that allocative inefficiency, or resource misallocation, has dragged down TFP growth in all three Baltics during the sample period (Figure 2).

5.   However, the role of allocative efficiency has varied over time, especially before and after the global financial crisis (GFC). Based on equation (11), Figure 3 shows that the contribution of allocative efficiency to productivity growth in Estonia was largely negative before the GFC, turned

$$\Delta \ln TFP_{ct} = \Delta \ln IN_{ct} + \Delta \ln AE_{ct} \tag{11}$$

positive during the post-crisis recovery period, but worsened again in recent years. In general, as unviable firms exit the market during economic crises, allocative efficiency tends to improve. In the case of Estonia, improvement in allocative efficiency after the GFC may have been driven by a combination of factors, including market corrections in asset prices, reassessment of risk, structural reforms, increased focus on efficiency by businesses, market discipline and policy interventions that may have facilitated more efficient resource allocation. Our study finds a broadly consistent pattern in the role of allocative efficiency for Latvia and Lithuania, which is in line with previous empirical studies of productivity developments before and after the GFC (for instance see Blanchard et al 2013).

6.   In Estonia and many other advanced economies, within-sector allocative efficiency plays an important role in productivity growth. Resource allocation across sectors is notably less important. The Spring 2024 World Economic Outlook (IMF 2024) finds a significant negative contribution of within-sector allocative efficiency to annual TFP growth for most advanced economies in the euro area, including Estonia (Figure 4). In contrast, within-sector allocative efficiency in the United States has helped promote TFP growth. Within-sector resource allocation matters, because inefficient firms may be forced to exit the market, freeing up resources that can be reallocated to more productive uses. This reallocation process enhances overall productivity by channeling resources to where they can be most effectively utilized.

Figure 2. Allocative Inefficiency Has Dragged TFP Growth in the Baltics

Baltics: TFP Growth Decomposition
(Change in natural log of TFP, annual average)

Sources: Orbis, EUKLEMS, Statistics Lithuania, IMF staff calculations.
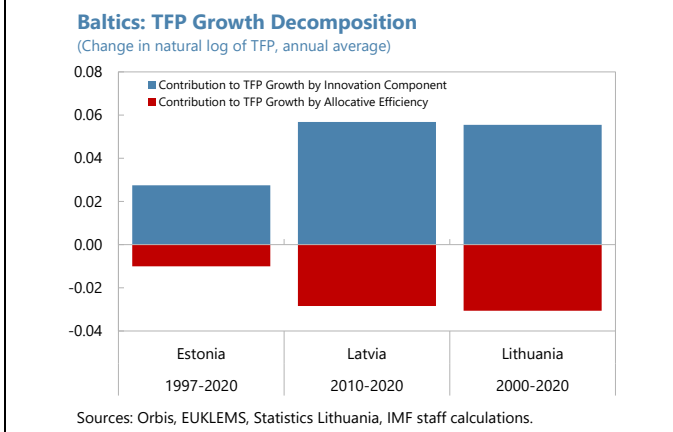
Figure 3. Allocative Efficiency Improved After the GFC with Limited Recovery

TFP Growth Decomposition
(Change in natural log of TFP)

Sources: Orbis, IMF staff calculations.

Figure 4. Within-Sector Allocative Efficiency Is More Important than the Shift Across Sectors

Contribution of Allocative Efficiency to Annual TFP Growth, 2000-19
(Percentage points, decomposed)

Sources: IMF World Economic Outlook, Chapter 3 (April 2024).
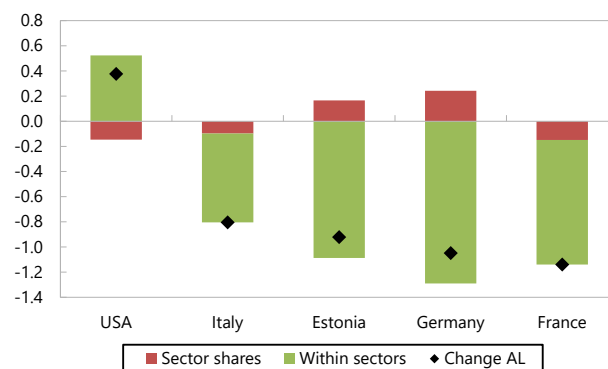
C. Allocative Efficiency in Estonia

7.   Productivity loss due to allocative inefficiency has been greater for services than for goods sectors. The difference is estimated to be about 8 percent of TFP for the Baltic region on average with a larger difference for Latvia and a smaller one for Lithuania (Figure 5). Among the reasons is that the services sectors generally tend to have more market frictions and barriers to competition compared to goods sectors. There may be more product differentiation in services, and firms tend to have greater market power than those in goods sectors. Inefficiencies may also reflect regulatory hurdles, licensing requirements and entry barriers that restrict competition and impede resource reallocation. As a result, inefficient firms in services may persist for longer than in goods sectors. In addition, information and communication technology as well as professional services rely on highly skilled workers. In Estonia, skill shortages in these sectors may have resulted in allocative inefficiency, leading to productivity losses and constraining growth.

Figure 5. Productivity Loss Due to Allocative Inefficiency Is Worse for Services than Goods

Baltics: TFP Loss Due to Misallocation by Sector Type
(Percent)
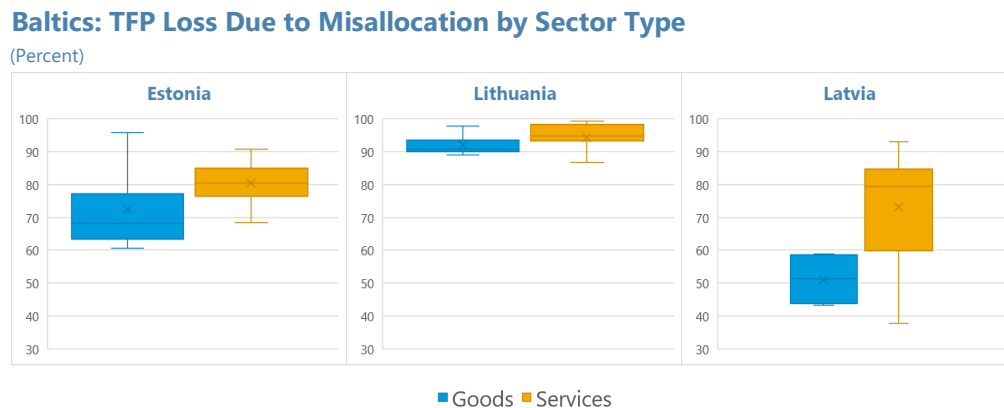
Sources: Orbis, Statistics Lithuania, IMF staff calculations.
Note: The middle lines in the bars represent the median, the x the mean, the bars the interquartile range, and the whiskers t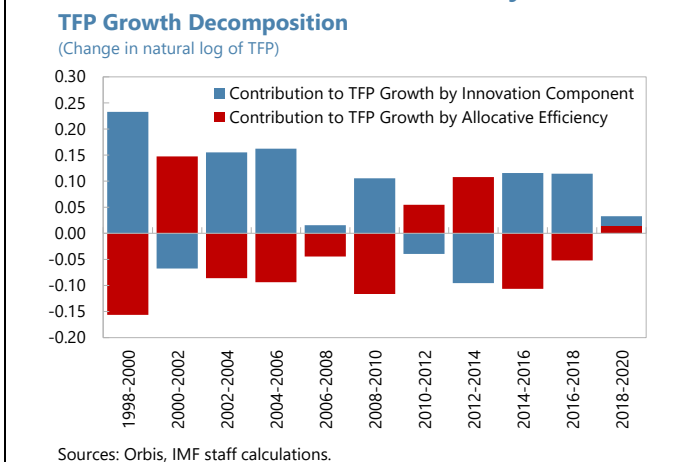he minimum and maximum values across samples in the group. The sample periods for each country are the following: Estonia (1997-2020), Lithuania (2000-2020), and Latvia (2010-2020).

8.   Allocative efficiency varies significantly across specific sectors in Estonia. In mining, electricity, and real estate resource misallocation worsened in the years leading up to the global financial crisis. In recent years allocative efficiency has deteriorated significantly for the mining sector. In several countries, government subsidies, trade barriers, or price controls have distorted market signals and hampered resource allocation in the mining sector, resulting in allocative inefficiency. Advances in mining technology and automation may also alter the cost structure and production processes within the mining sector. If firms fail to adopt new technologies or adjust their operations accordingly, they may become less competitive and experience allocative inefficiency. It is unclear to what extent specific frictions may have played a role in the case of Estonia, but the signification deterioration calls for further analysis, which goes beyond the scope of this work.

9. **The variance across firms in the marginal revenue product of capital has increased steadily in the case of Estonia** (Figure 6). A proxy for allocative inefficiency is the dispersion of marginal revenue product of capital and labor (Hsieh and Klenow 2009). In an ideal world without any distortions, the marginal revenue product of capital and labor is equal to the marginal cost for each respective production factor and equalize across firms. With distortions, there is a dispersion in the marginal revenue products. For instance, we can think of a hypothetical scenario with two otherwise identical firms: one has low productivity but

Figure 6. Variance of Marginal Revenue Product of Capital Has Increased in Recent Years

Variance of Marginal Revenue Product of Capital
(Natural log, 3 year moving average)

Sources: Orbis, IMF staff calculations.

easier subsidized access to credit, while the other has high productivity but must pay a higher premium on access to credit because of distortions in capital markets. If resources were allocated in an optimal manner, more capital would flow to the high-productivity firm, such that the marginal revenue product of capital is equal to the marginal cost of capital. The extent to which the marginal revenue product of capital is dispersed is a measure of the severity of capital misallocation.

10. **The dispersion in productivity has also increased over time (Figure 7).** The variance of productivity across firms is also an indicator of allocative inefficiency. Unproductive firms may coexist with productive firms if the economy is not sufficiently dynamic, and resources are not guided by strong market discipline (Decker et al 2017). A wide dispersion in productivity levels among firms or sectors within an economy suggests that capital, labor, and technology are not being allocated in an optimal manner. Some firms may be operating at significantly higher levels of productivity than others, indicating that resources

Figure 7. Dispersion in Productivity Increased Over Time

Variance of TFPR
(Natural log)

Sources: Orbis, IMF staff calculations.

are misallocated towards lower-productivity firms. Such dispersion may be due to market distortions, such as barriers to entry, imperfect competition, information asymmetry, or government intervention, and implies a potential for improvement in resource allocation.
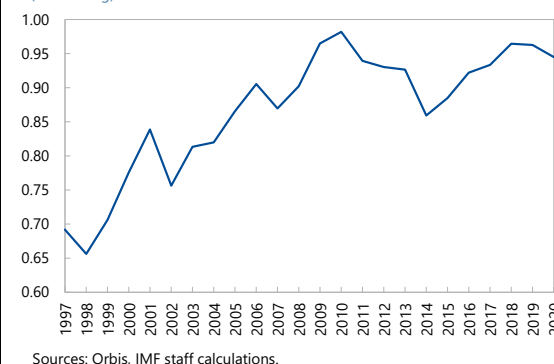
11. **The increasing dispersion in productivity is more prominent for mining and real estate sectors, providing further evidence for allocative inefficiency (Figure 8).** Market structure within these sectors may have contributed to dispersion in productivity. In industries with limited competition and higher barriers to entry, firms may face less pressure to improve productivity or innovate. And with less competition, inefficient firms may survive along with more productive firms,

leading to wider dispersion in productivity. Industries such as mining and real estate tend to involve heterogeneous resources and assets. Factors such as the quality and availability of mineral deposits can vary widely across locations. In the case of real estate, factors such as location, property quality and market demand can vary significantly and lead to dispersion in productivity among firms. However, the increasing dispersion in productivity over time suggests that allocative inefficiency has worsened, likely undermining productivity growth.

Figure 8. Dispersion of Productivity Increased in Mining and Real Estate in Estonia

Variance of TFPR across Firms by Sector
(Natural log)

Sources: Orbis, IMF staff calculations.
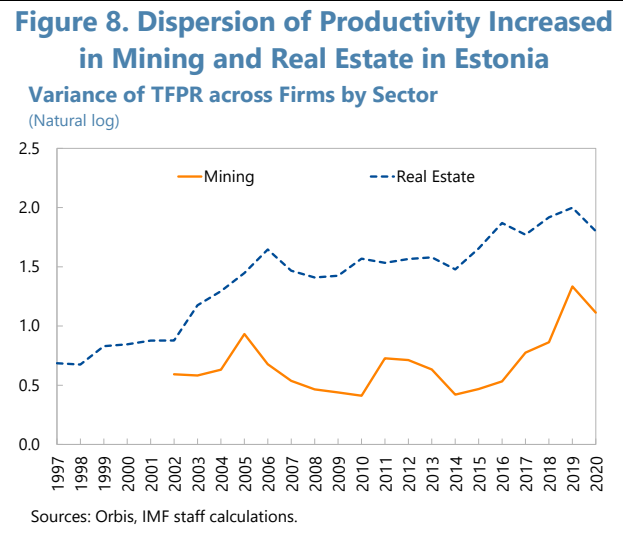
D. Allocative Efficiency and Structural Policies

12.   Structural reforms can help improve allocative efficiency, support productivity growth and restore competitiveness for Estonia. Less regulation in product market and more liberalization in financial and labor markets are generally associated to better allocative efficiency (IMF 2024[3]; Figures 9-11[4]). Indicators of product market regulation and financial market liberalization place Estonia in a favorable position compared to other advanced and emerging market economies (Figures 9 and 10). However, when it comes to labor market liberalization, evidence from the IMF structural reforms dataset on labor market suggests some room for improvement (Figure 11). Labor market measures protecting jobs in economic downturns may come at the cost of labor market flexibility. For instance, recent research suggests that government programs such as job retention schemes in response to the pandemic may have hampered efficient labor allocation and led to productivity losses (Meriküll and Paulus 2024).

Figure 9. Less Regulation in the Product Market Is Related to Better Allocative Efficiency

Sources: IMF World Economic Outlook, Chapter 3 (April 2024).

Note: The red dot indicates Estonia.

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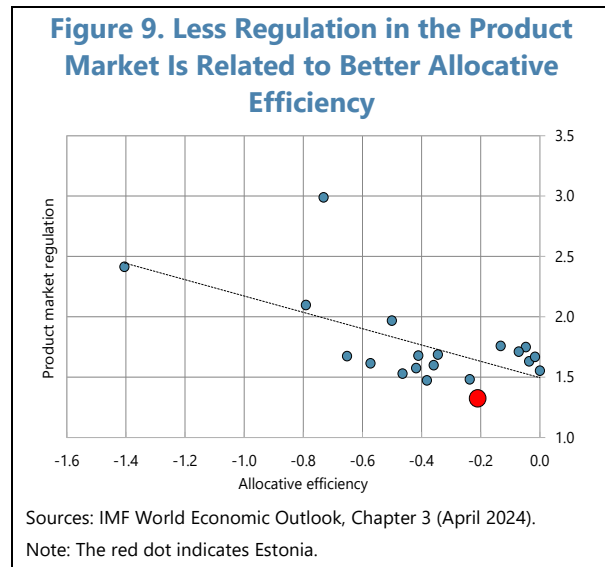
[3] IMF, World Economic Outlook, Chapter 3, April 2024.

[4] For Figures 9-11, the data comes from the IMF Structural Reforms Dataset, with 2014 as the latest period. The countries in the sample are Austria, Belgium, Bulgaria, Switzerland, China, Czech Republic, Germany, Estonia, Spain, France, Italy, Japan, Korea, Poland, Portugal, Romania, Russia, Slovenia, Slovak Republic, and United States.

Figure 10. Financial Market Liberalization Is Associated with Better Allocative Efficiency
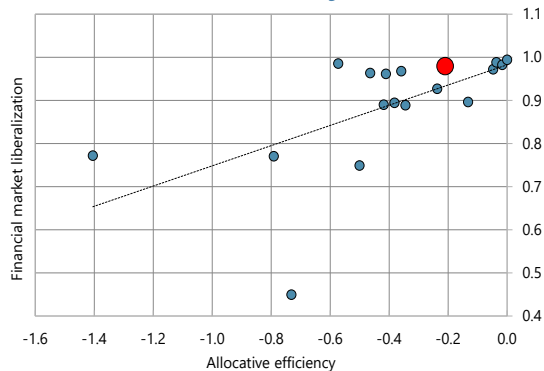
Sources: IMF World Economic Outlook, Chapter 3 (April 2024).

Note: The red dot indicates Estonia.

Figure 11. Labor Market Liberalization Is Related to Better Allocative Efficiency
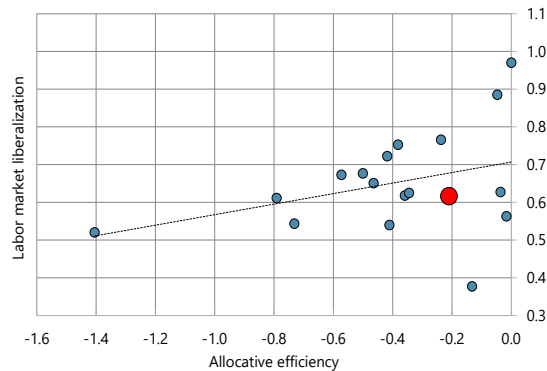
Sources: IMF World Economic Outlook, Chapter 3 (April 2024).

Note: The red dot indicates Estonia.

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Meriküll, Jaanika and Alari Paulus, "Were jobs saved at the cost of productivity in the COVID-19 crisis?" *European Economic Review*, Volume 161, 2024, available at https://doi.org/10.1016/j.euroecorev.2023.104618

BENCHMARKING ESTONIA'S PUBLIC FINANCES – A PRIMER[1]

Emerging needs to strengthen national security and accelerate the energy transition add to long-standing ageing-related pressures. Growing tension between retaining a historically competitive low tax environment and moving towards broader provision of public services and a stronger social safety net may lead to further fiscal deterioration, if left unaddressed.

A. Introduction

1.   Recent changes in the global economic and geopolitical landscape have significant implications for public spending. New spending needs stem from the goals to strengthen national security and accelerate the green and energy transition. At the same time, governments face long-standing spending pressures in ageing-related areas such as pensions and healthcare.

2.   In Estonia, these pressures have already resulted in a deterioration of public finances. As spending pressures materialize into larger fiscal deficits more recently, there is also a growing debate in Estonian society whether to move closer to an economic model that emphasizes broader provision of public services and stronger social safety nets or retaining a competitive, low tax system which has helped attract investment and create a business-friendly environment. If left unaddressed, this tension may lead to further fiscal slippage.

3.   Fiscal pressures are already visible in budget developments. To the extent that some of the new spending is either permanent or contains a strong inertial component, whereas decisions on new revenue measures follow with a lag, unfavorable dynamics for public finance and inefficient policy outcomes in the form of fast increase in public debt and interest payments may ensue.

4.   This paper undertakes a high-level benchmarking exercise. Spending categories—by economic concept and by function—and revenue items are compared across relevant regional peers. The goal is to identify levels and trends relative to comparator country groupings—other Baltic neighbors (i.e., Latvia and Lithuania), Nordic countries (i.e., Denmark, Finland, Norway, and Sweden), and the Euro Area (EA20)—that can help identify options of potential expenditure-based consolidation and of revenue mobilization.

B. Expenditures

5.   Estonia's government spending has been relatively low, despite increasing markedly after the Global Financial Crisis (GFC). Estonia's government expenditures as share of GDP were the lowest among the comparator groups and on a declining trend until 2007 (Figure 1). Despite

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

increasing by almost 3 pp between 2011 and 2023, Estonia's government was still spending relatively less compared to peers, although broadly in line with the other Baltics.

6.   Estonia and the Baltics remain among the countries with the lowest government spending in Europe. Over 2017-2023, Estonia's government spending as share of GDP was on average only higher than that of Ireland, Lithuania, Romania, and Malta, and just below that of Latvia (Figure 2).

7.   The pandemic led to a temporary increase in Estonia's government spending which lately resumed. In the five years prior to the pandemic, Estonia's general government spending averaged less than 38 percent of GDP, about 6.5 and 11 percentage points less than the average of the Euro Area (EA20) and the Nordic countries respectively. In response to the pandemic, spending went up by about 5 pp of GDP, largely reversed in 2021-2022, but spending was on the rise again in 2023. For comparison, in the Nordic countries and the EA20, the post-pandemic decline in government spending as a share of GDP was 8.3 and 4.1 percentage points respectively. By 2023, the gap between Estonia and the Nordics was reduced to 8.5 percentage points of GDP, while remaining about the same in comparison with the EA20. The other two Baltic countries followed a similar profile as Estonia, but with higher spending in Latvia and lower in Lithuania (Figure 3).

8.   A decomposition of Estonia's government spending by economic transactions shows a more nuanced picture. While Estonia's government spends less than the Nordics and the EA20, the relative underspending comes from

Figure 1. Government Expenditures, 1995-2023
(Percent of GDP)
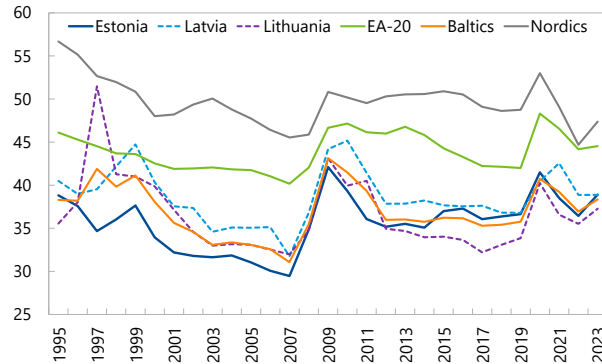
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Figure 2. Government Expenditures, 2001-2023
(Percent of GDP)
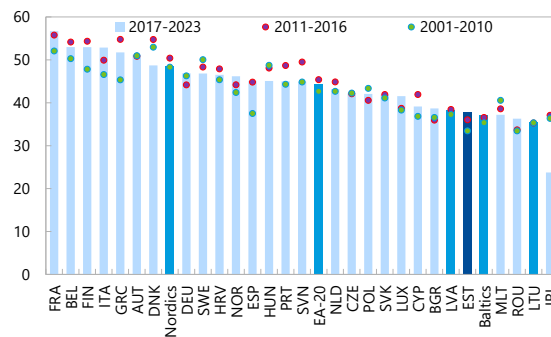
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Figure 3. Government Expenditures, 2015-2023
(Percent of GDP)
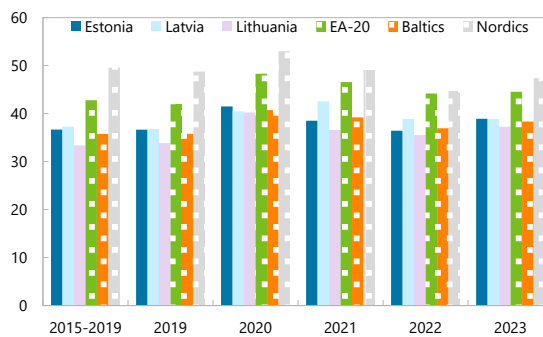
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

interests, subsidies, and social benefits, the three categories on the left-hand side of Figure 4. On government consumption (i.e., compensation of employees and purchase of goods and service) and public investment (i.e., capital expenditures), Estonia *already* outspends the EA20, although it still lags the Nordics (except on capital expenditures).

Figure 4. Government Expenditures by Economic Transaction, 2001-2023
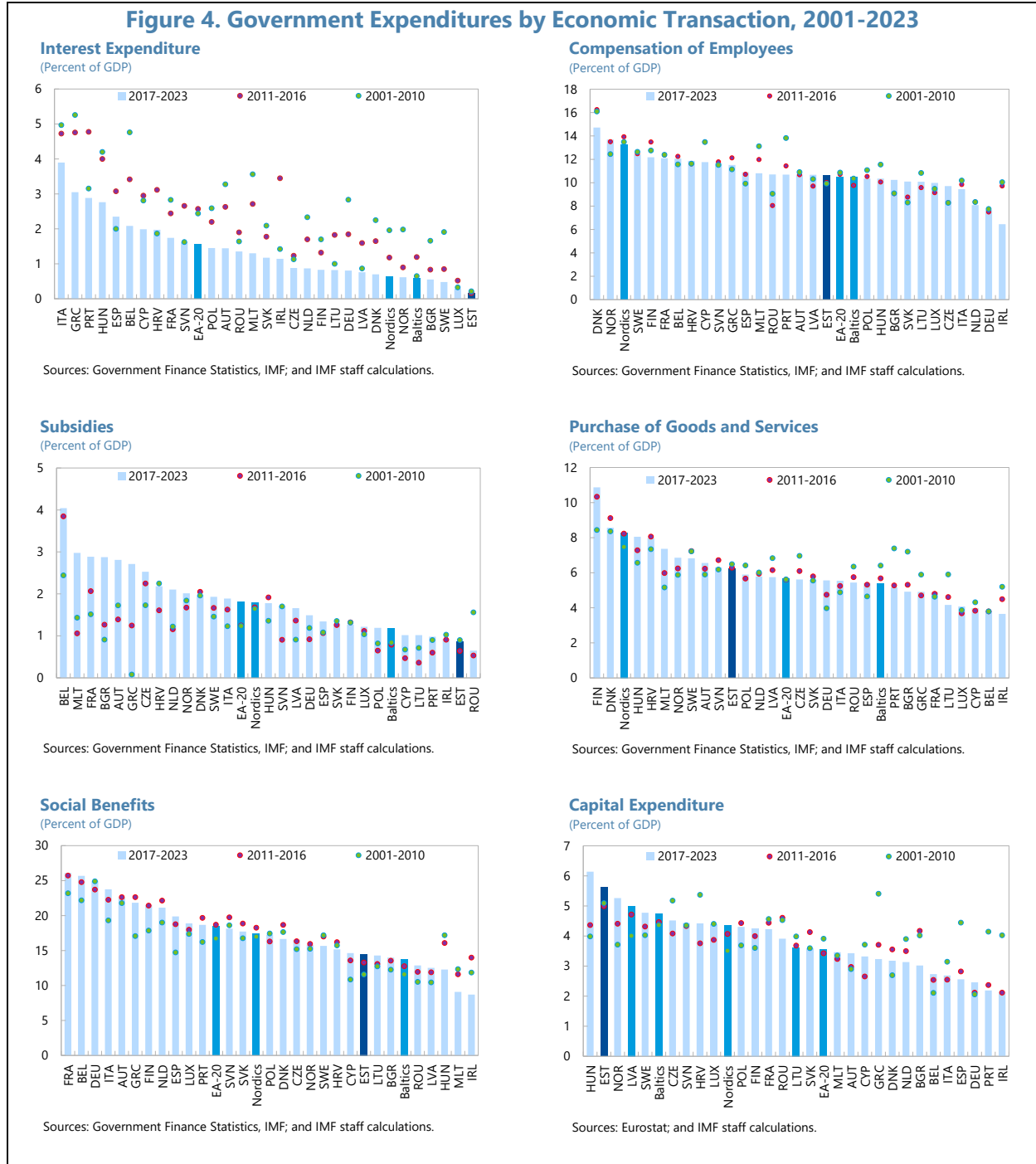
9. **While being broad-based, the post-GFC increase in Estonia's government expenditures as share of GDP shows some important differences**. Figure 5 highlights a clear rising trend for

compensation of employees, capital expenditures, and social benefits. While purchase of goods and services also increased in response to the GFC shock, a more stable path followed afterwards. In contrast, interest expenditures extended their declining trend, given the low public debt. The trend reversed only recently on rising debt and higher interest rates.

Figure 5. Government Expenditures by Economic Transaction, 1995-2023

Interest Expenditure
(Percent of GDP)
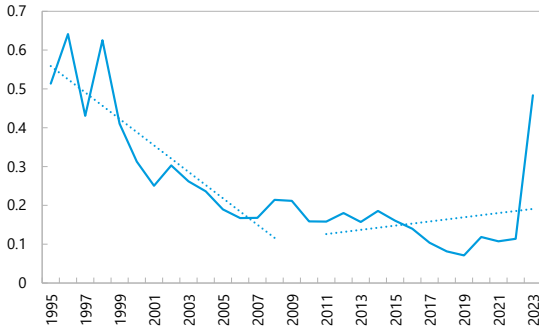
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Compensation of Employees
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Subsidies
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Social Benefits
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Capital Expenditures
(Percent of GDP)

Sources: Eurostat; and IMF staff calculations.

Purchase of Goods and Services
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

10. **The increase in Estonia's government spending since 2011 is largely explained by capital expenditures, the wage bill, and the cost of social benefits.** By 2023, almost all categories of government spending by economic transaction have increased relative to their pre-GFC levels. However, compensation of employees and social benefits—which includes both pensions and employment related benefits—explained about 90 percent of the change,

**Figure 6. Change in Government Spending Over 2011-2023**
(Percentage points of GDP)

Sources: Government Finance Statistics, IMF; Eurostat; and IMF staff calculations.

while capital expenditures contributed with 3 pp. In contrast, Nordics and EA20 have *reduced* total expenditures as share of GDP in almost all categories of spending, and especially in compensation of employees, social benefits, and interests (Figure 6).
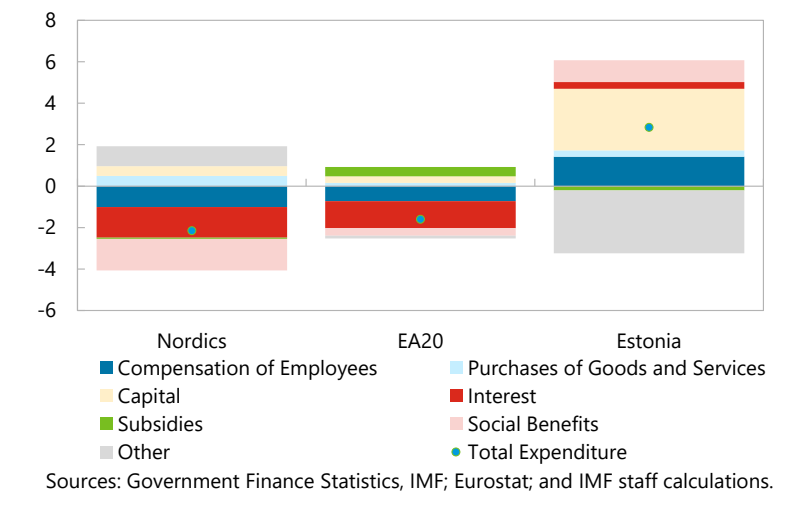
11. **As Estonia's per capita income increases, so does the expectation of better coverage and quality of public services.** Benchmarking against the Nordics and the EA highlights important structural differences, despite the recent reduction in government spending among these comparators. Figure 7 shows that, except for capital expenditures, Estonia still underspends both the EA20 and the Nordics in all categories of spending by economic transaction. That is especially the case for spending on social

Figure 7. Government Expenditure Differential with Nordics and Euro Area
(Percent of GDP)

Sources: Government Finance Statistics, IMF; Eurostat; and IMF staff calculations.

benefits, on which the gap is still about 3 pp and 4 pp of GDP respectively.
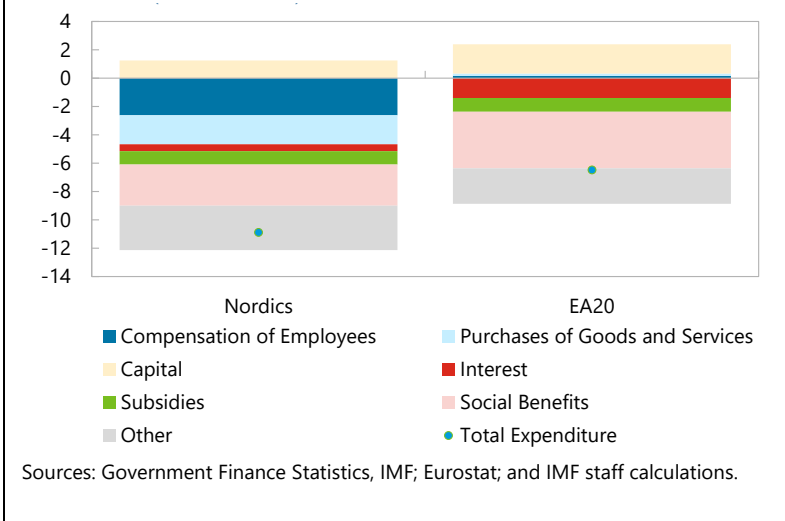
12. **Competing spending pressures emerge.** To sum up, Estonia (i) already outspends peers such as the EA20 on public investment and operational costs to provide public services (i.e., compensation of employees and purchase of goods and services), (ii) will experience an increase in interest payments—one category on which Estonia clearly underspends its peers and which will

divert resources to debt service, and (iii) may face demand for broader social safety nets and better-quality public services.

13. **New spending needs become apparent when assessing Estonia's expenditures by function.** The three charts on the left-hand side of Figure 8 show that Estonia underspends its EA20 and Nordic peers on health and social protection and the EA20 on environment protection. Future demand for these categories of spending is likely to increase due to population ageing and the commitment to the green and energy transition.

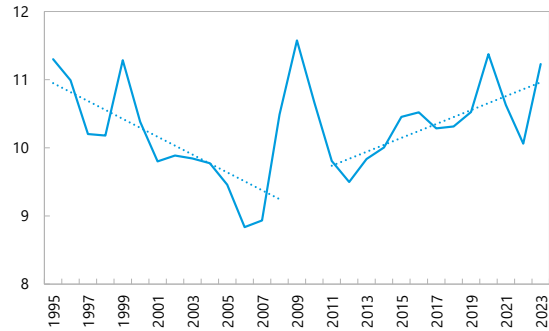**Figure 8. Government Expenditure by Function, 2001-2022**

Health Expenditure
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Defense Expenditure
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Social Protection
(Percent of GDP)
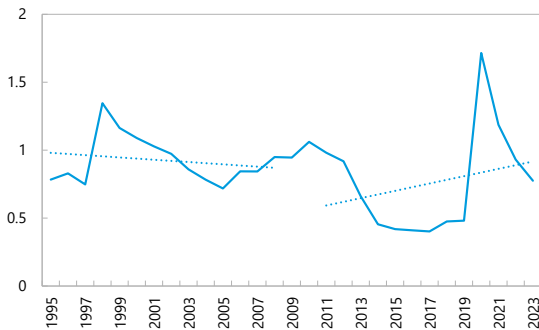
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Education
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.
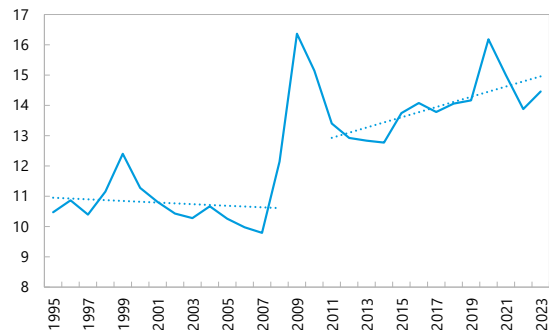
Environment Protection
(Percent of GDP)
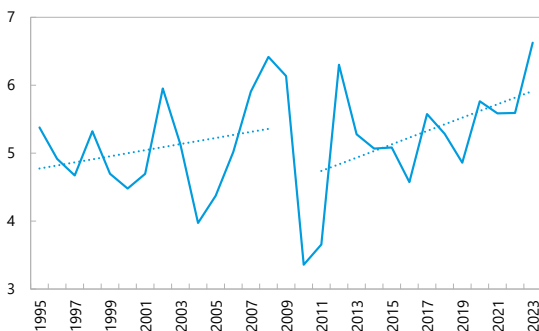
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

R&D
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

14. **Savings in other areas appear unlikely.** Estonia outspends its peers in other categories—defense and education—and the Nordics on R&D—but spending in these areas will unlikely recede, given geopolitical tensions and the need to support the country's productivity and economic transformation. Moreover, the ongoing decline of spending in education, R&D, and environment protection (Figure 8) make these categories less likely candidates to accommodate higher spending elsewhere.

Figure 9. Government Expenditures by Economic Transaction, 1995-2022

Defense Expenditure
(Percent of GDP)
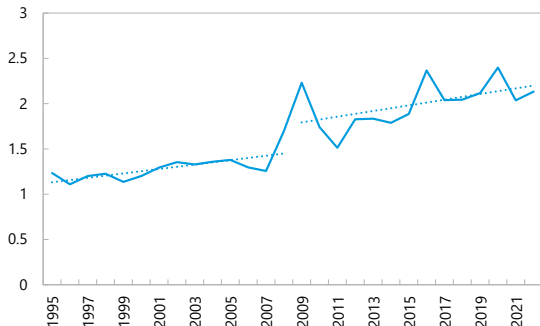
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Education
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.
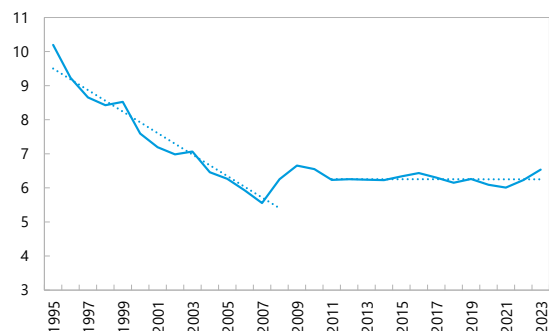
Social Protection
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

R&D
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Health
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Environment Protection
(Percent of GDP)
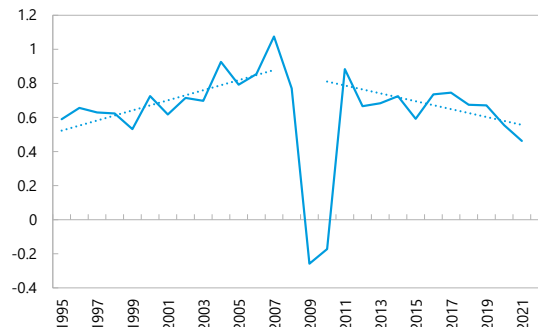
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

C.   Revenues

15.   Estonia's low government spending has been met with similarly low government revenues as share of GDP. Over 2017-2023, Estonia's general government revenue has been on average significantly lower than that of the Nordics and the EA20, albeit slightly higher than that of the other Baltic countries (Figure 10).

16.   This relative ranking has also been reflected in historical trends. Following a decreasing trend through 2005, with a trough of 34 percent of GDP, the average government revenue in Estonia permanently increased by about 3 pp of GDP after the GFC, remaining broadly stable at about 38 percent of GDP since then. As of 2023Q2, the Estonian government mobilized 39.3 percent of GDP, still about 13 pp and 4 pp of GDP less than the Nordic countries and the EA20 respectively (Figure 11).

17.   Estonia's general government revenues have been lower relative to peers even after controlling for per capita income. Results from a time- and country-fixed effect panel regression of total government revenues as share of GDP on real per capita income over the period 2000-2022 can be used to construct a "counterfactual" path had Estonia mobilized revenue in line with its per capita income. Except for 2009-2010, the fitted share of revenues suggests that actual revenue collection is on average 2.7 pp of GDP below what would be expected given Estonia's per

Figure 10. General Government Revenues, 2001-2023
(Percent of GDP)

Sources: Government Finance Statistics, IMF; World Economic Outlook, IMF; and IMF staff calculations.

Figure 11. Government Revenues, 1995-2023
(Percent of GDP)
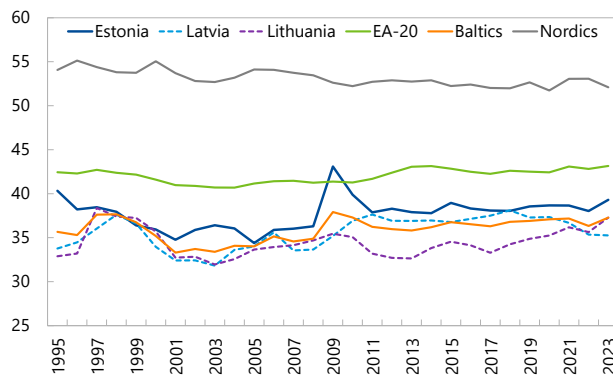
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Figure 12. Actual and Counterfactual Total Revenues, 2000-2022
(Percent of GDP)
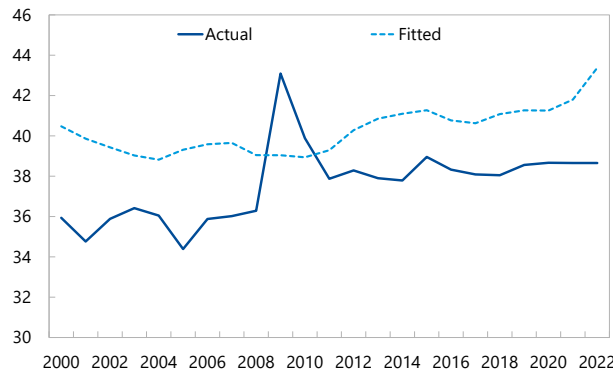
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

capita income (Figure 12). While recognizing that Estonia's low, competitive tax system has been serving Estonia well, this result suggests that, along with consolidation efforts on the spending side, space for additional revenue mobilization appears available.

Figure 13. Tax Revenues, 1995-2022

Tax Revenues (Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Property Tax (Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Personal Income Tax (Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Excise Taxes (Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Corporate Income Tax (Percent of GDP)
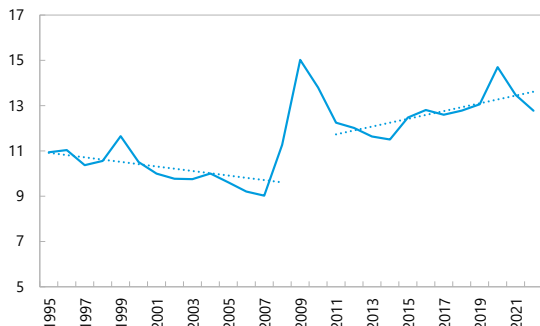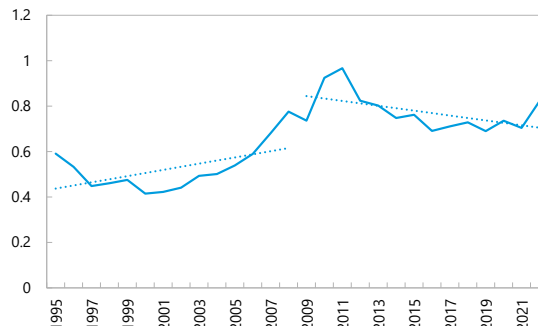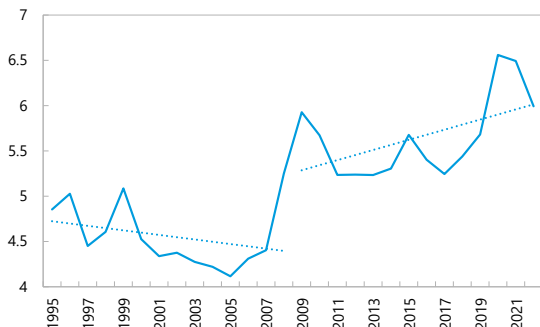
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

VAT (Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

**18.   Tax revenues have generally increased since 2011, except for property and excise duties.** Like in the case of government spending and total revenues, a declining trend in tax

revenues came to a halt with the GFC. Since then, against the backdrop of relatively stable total revenues as share of GDP the share of tax revenues increased. However, the observed increase (2 percentage points of GDP) fell short of the increase in spending (+ 2.8 pp) over the same period. The increase was also not homogeneous across types of taxes. Revenues from both the personal income tax (PIT) and value-added tax (VAT) increased by about 1 percentage point of GDP between 2011 and 2023, and corporate income tax (CIT) collection increased by about 0.6 pp. On the other hand, already historically low revenues from property taxes have declined further while excise duties generated less 1.5 pp of GDP in revenues since 2011 (Figure 13).

19.   Relative to peers, Estonia's tax revenue-to-GDP ratio has been also generally low, although with important differences across types of taxes. While total tax collection by 2022 (last year for which comparable cross-country data is available) was about 4 pp and 16 pp lower than in the EA20 and the Nordics, respectively, revenue levied through excise duties, VAT and social contributions was broadly comparable or even higher than that of Baltic peers, the Nordics, and the EA20 (Figure 14). On the other hand, revenues from personal income taxes and, *especially*, corporate income and property taxes, were significantly lower than in comparator country groups. Property taxes yield only 0.2 percent of GDP in revenues in Estonia, which is about 4 times less than in the EA20 and the Nordics. Similarly, CIT revenues are 1.7 percent of GDP in Estonia, while four times larger in the Nordics and twice as high in the EA20. Estonia ranks almost last in Europe in both categories of taxes (Figure 15).

Figure 14. Tax Revenues, 2022

Tax Revenues, 2022
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Property Tax
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Personal Income Tax
(Percent of GDP)

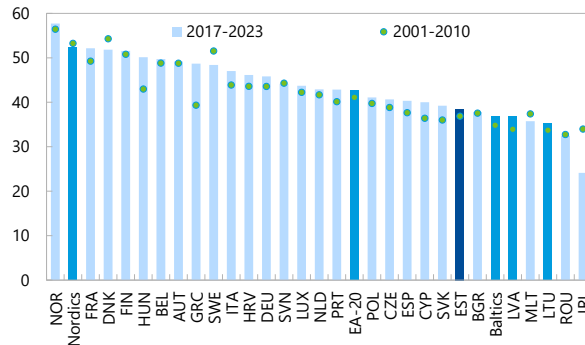Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Excise Taxes
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Figure 14. Tax Revenues, 2022 (concluded)

Corporate Income Tax
(Percent of GDP)
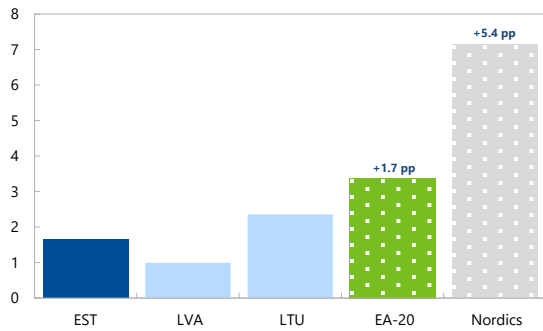
VAT
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.
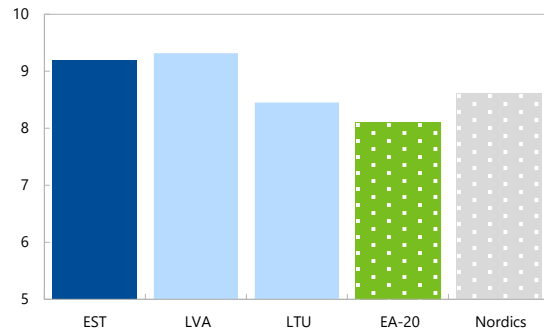
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Social Contributions
(Percent of GDP)
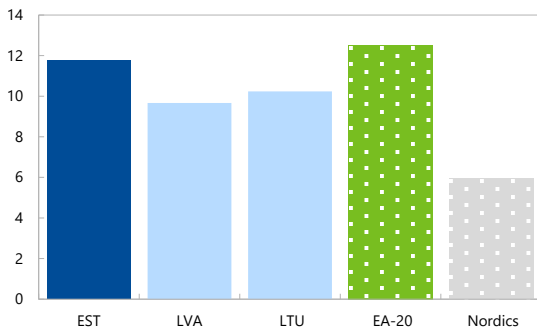
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

Note: Figures on top of selected country data reflects the difference relative to Estonia.

Figure 15. Revenues from CIT and Property Taxes, 2001-2022

Corporate Income Tax
(Percent of GDP)
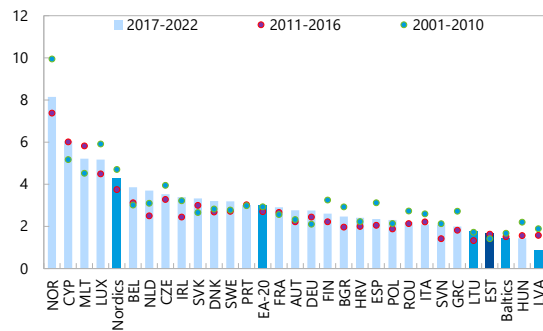
Property Tax
(Percent of GDP)

Sources: Government Finance Statistics, IMF; and IMF staff calculations.
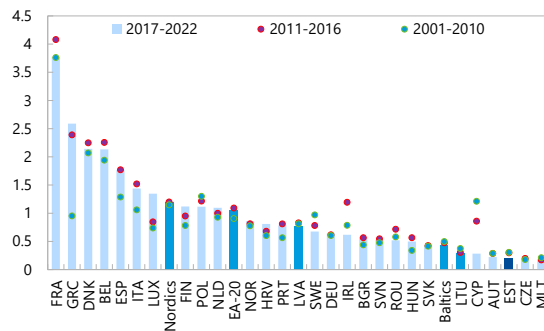
Sources: Government Finance Statistics, IMF; and IMF staff calculations.

D. Conclusions

20.   Estonia's public finances face a tension building between historically low taxation and upward-trending government spending. A benchmarking of government spending, both over time and against natural comparators (i.e., Nordics, EA20, and other Baltic peers), suggests emerging spending pressures on defense that add to long-standing ageing-related spending (e.g., health, pensions, and old-age benefits), and expectations of broader provision of public services. At the same time, Estonia's government revenues have been broadly stable since after the Global Financial Crisis and generally lower than Nordic and European peers.

21.   While showing lower spending levels relative to peers, spending is already on an upward trend. Estonia currently underspends comparators on health, social protection, and environment protection—areas that will likely face future spending pressures—and outspends the EA20 average on public consumption and investment. Increasing interest expenditures in the face of larger debt and higher interest rates will continue to divert resources from other areas. Other areas in which Estonia outspends comparators—such as defense, education, and R&D—are unlikely to provide material cost savings given their strategic role.

22.   Along with consolidation efforts on the spending side, options for revenue mobilization appear available. Although total tax revenues as share of GDP are generally lower in Estonia than in Nordic countries and the EA20 comparators, tax on consumption (i.e., VAT and excise duties) and labor (i.e., social contributions) are either at par or higher than in those comparator country groupings. On the other hand, less distortionary taxation such as corporate income and property taxes yield significantly less government revenues in Estonia than in both Nordic and European comparators.

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ESTONIAN BANKS: CAPITALIZATION, PROFITABILITY, AND REGULATORY IMPLICATIONS[1]

Estonian banks have remained resilient despite a challenging macroeconomic environment. However, capital adequacy has gradually declined over time and small banks are less capitalized. Reliance on Internal Ratings-Based (IRB) models in some banks has historically resulted in lower risk weights and higher capital ratios. A recent large one-off dividend payout might have indirectly bolstered fiscal revenue but further reduced bank capital ratios. Looking forward, the authorities should encourage banks to channel profits towards capital buffers, while ensuring that credit risk is properly reflected in risk weights across the banking system for both residential mortgages and NFC loans.

A.   Background

1.   Banks represent the largest share of the Estonian financial sector, accounting for about 70 percent of the country's financial assets (Eesti Pank, 2023a). Following a period of rapid growth, banks' assets have increased from around 100 percent of GDP in 2012 to 136 percent currently. Nevertheless, the banking system remains relatively small in comparison with euro area peers (Figure 1).

2.   The banking sector is highly concentrated and dominated by foreign-owned banks. It comprises nine licensed banks (down from 42 in 1992), and five branches of foreign banks (Figure 1). Four banks are classified as other-systemically important institutions (O-SII) by Eesti Pank and are supervised by the ECB. The largest bank in terms of assets is Luminor, which was established in 2019 out of the Baltic banking assets of Nordea and DNB and is currently majority owned by US investment firm Blackstone. Luminor has branches in Latvia and Lithuania and has sizeable loan portfolios in these countries. The second and third largest banks are Swedish-owned Swedbank and SEB. The fourth O-SII is Estonian-owned LHV Pank, which is publicly listed on the Tallinn stock exchange. The remaining banks are much smaller, with a combined market share of about 10 percent. In addition, foreign banks that are active in Estonia through branches account for about 3 percent of banking system assets. Their importance has been declining.

3.   Estonian banks operate a conservative, traditional business model. The majority of banks' assets are loans to households and non-financial corporations (NFCs), which constitute 45 percent and 41 percent of total bank lending, respectively. Of the stock of NFC loans, over 42 percent are directed towards the real estate and construction sectors. Thus, developments in the real estate market have the potential to significantly impact the loan portfolio of the banking sector. Reflecting the low indebtedness of the Estonian public sector, loans to the government and holdings of government bonds represent a relatively small portion of banks' assets in international

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[1] Prepared by Gianluigi Ferrucci and Sadhna Naik.

Figure 1. Bank Assets to GDP Ratio and Market Share by Assets

Ratio of Bank Assets to GDP
(Percent)

Market Shares by Assets
(Percent)

Sources: European Central Bank; Eurostat; and IMF staff calculations.

Source: Financial Supervision Authority
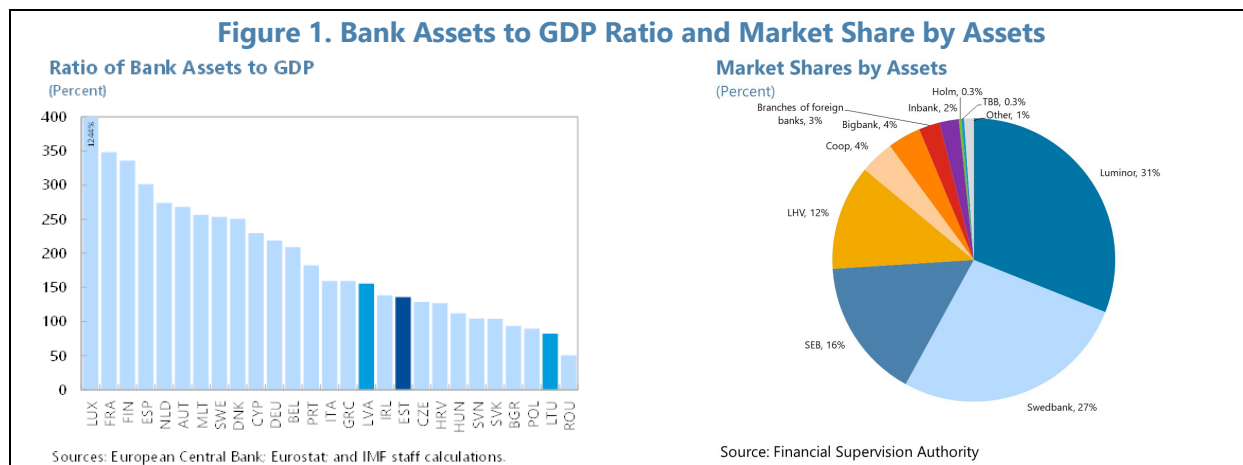
comparison. The primary source of funding for the banks' loan portfolio is deposits, which account for approximately 81 percent of liabilities (see Figure 2).

4.   Several macroprudential measures have been in place since 2014. A countercyclical capital buffer (CCyB) of 1 percent has been in effect since July 2022 and subsequently raised to 1.5 percent in December 2023. The four O-SIIs are required by Eesti Pank to maintain additional institution-specific capital buffers of 2 percent, on top of the regulatory and the pillar-2 based capital requirements and buffers.[2] Furthermore, for banks that use the Internal Ratings-Based (IRB) approach to calculate regulatory capital requirements, Eesti Pank requires a minimum risk weight (RW) of 15 percent on mortgage loans extended to Estonian households.[3] Loan-to-value (LTV), debt service-to-income (DSTI), and maximum maturity requirements are also in effect for banks issuing housing loans (Figure 2).

Figure 2. Balance Sheet Structure and Macroprudential Measures Currently in Effect

Banking Sector Balance Sheet Structure, 2023Q2
(Percent; measured as a share of total assets or equity and liabilities)

Source: Financial Supervision Authority.

Macroprudential Measures of Eesti Pank

Measure	Requirement	Details
Countercyclical capital buffer	1% (1.5% from Dec. 1, 2023)	
Other systemically important institutions buffer	2%	Swedbank AS AS SEB Pank Luminor Bank AS AS LHV Pank
Risk weight floor for mortgage loans	15%	Floor applies to credit institutions that use the internal risk based (IRB) approach. Effective as of 2019
Requirements for issuing housing loans		The limits may be breached by 15% of the volume of mortgages issued each quarter
Loan-to-value limit (LTV)	85%	
Debt service-to-income limit (DSTI)	50%	The calculation of payment must use the interest rate set in the contract plus two percentage points or 6%, whichever is higher. The 2pp add-on is discontinued from Apr. 1, 2024
Maximum maturity	30 years	

Source: Eesti Pank, Financial Stability Review, 2023/2

5.   Financial soundness indicators suggest that Estonian banks have remained strong, despite facing a challenging macroeconomic environment. The system's capital adequacy ratio

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[2] Banks are required to maintain a capital conservation buffer of 2.5 percent of risk-weighted assets on top of the base requirements for own funds (Eesti Pank, 2023b).

[3] In Estonia, only two banks, Swedbank and SEB, use the IRB approach to calculate regulatory capital requirements.

(CAR) is among the highest in the EU, at 22.6 percent (Figure 3). Profitability is sound and well above EU average, with a return on equity (RoE) that has been consistently around 5–7 percent in recent years – about 2 percentage points higher than in the EU – and that, like elsewhere, has further improved in 2023.[4] Banks are liquid and fully funded by domestic customer deposits. The banking system's liquidity coverage ratio (LCR) is over 175 percent, compared to a minimum requirement of 100 percent, which all banks fulfil with a wide margin.

6.   **Although resident deposits fully cover the loan book of the banking sector as a whole, there are differences across banks.** Several banks fund their activities by taking in deposits from EU residents, including through online platforms. The volume of non-resident deposits has remained broadly constant over the past two years, accounting for about 12 percent of total liabilities in 2023. Deposits sourced through online platforms are 3 percent of total sector deposits (Finantsinspektsioon, 2023). Depositors from Germany and the Netherlands are particularly active suppliers of funds through this channel.

7.   **Non-performing loans are low at 1.2 percent of total loans, lower than before the pandemic.** For context, in the wake of the 2008 global financial crisis, when Estonian house prices fell by over 40 percent, the share of 60 days past due loans peaked at 7.5 percent of the total loan book. Given that corporate taxation favors retention of profits, Estonian firms have low leverage and considerable capital buffers. Stress tests that predate Russia's war on Ukraine and the current economic difficulties indicated that Estonian banks should be able to withstand plausible economic shocks (IMF, 2022).

Figure 3. Key Performance Indicators of Estonian Banks

Capitalisation of Banks
(Percent of risk-weighted assets)

Source: Financial Supervision Authority; Bank of Estonia; and IMF staff calculations.

Banking Sector Indicators 1/
(Percent)

Sources: Consolidated Banking Statistics, ECB; Supervisory Banking Statistics, ECB; and Haver Analytics.
1/ Scaled by different factors for visualization purposes.
2/ Displays inverted NPL ratio.

B.   Recent Developments

8.   **Estonian banks are operating in an increasingly challenging macroeconomic environment.** Financing conditions have tightened, and new lending has decelerated according to

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[4] Compared to other measures of profitability, ROE indicators also reflect the high capital levels accumulated post-GFC to build buffers and enhance financial stability, a trend not specific to Estonia but seen across all banks, especially in Europe.

the ECB bank lending survey. Demand of loans for house purchases and, especially, business investment has slowed sharply, on the back of tight monetary policy and negative sentiment hindering investment (Figure 4).

9.   **A resilient labor market until recently and low corporate leverage have cushioned the impact of higher interest rates on borrowers' balance sheets so far.** Labor market conditions are now weakening, though only moderately. Furthermore, over 90 percent of corporate bank loans have floating interest rates, and thus the rise in policy rates has passed through quickly into the debt servicing costs of companies. The average interest rate on the stock of corporate loans rose from 2.6 percent in 2021 to 6.2 percent in the third quarter of 2023. The increase in interest expenses has had the largest impact in sectors where financial leverage is high and interest is a large part of expenses, such as energy, real estate, transport and storage, and accommodation and food services.

Figure 4. Bank Lending Developments

Credit and Deposit Growth
(in percent)

Outstanding Loans
(year-on-year percentage change)

Sources: Bank of Estonia; and Haver Analytics.

Sources: Haver Analytics; and IMF staff calculations.
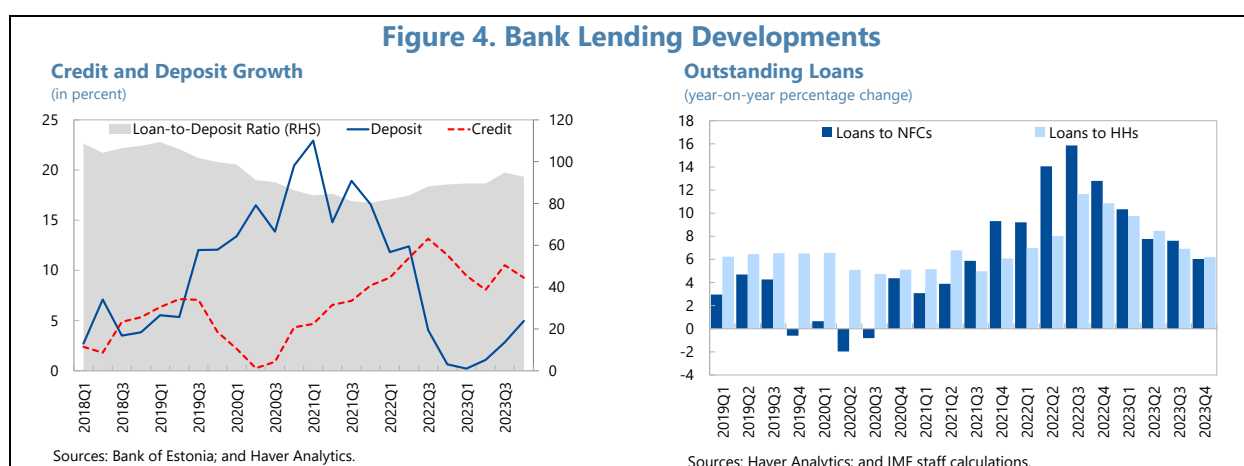
10.   NPLs could increase in the wake of the prolonged recession. Banks' loan portfolios have withstood the pandemic and the war shocks well, including due to the structure of the economy (in which COVID-sensitive sectors were relatively less important than in other countries while direct and indirect exposures to Russia were limited, despite the strong trade links and supply-side disruptions, see Figure 5). An exception is the accommodation sector, which makes up only a small part of the banks' loan portfolios (1.4 percent of banks' total loan book) and whose assets have fully recovered. However, signs are emerging that credit quality has started to deteriorate in some sectors, e.g., transport, construction, manufacturing, and some professional services. These sectors account for around 40 percent of banks' loan books. It is therefore important to closely monitor these developments for financial stability.

11.   Like elsewhere, bank profits have increased markedly, driven by rising net interest income, but the surge is largely cyclical. Tighter monetary policy and the general rise in interest rates have boosted the interest income of Estonian banks (Figure 5). This is a result of banks' loan portfolios in Estonia being mainly floating interest rates. As base interest rates have risen steeply since August 2022, interest income of banks has also increased sharply. However, banks' funding costs are also rising, as depositors switch from demand to term deposits. This pattern is more

pronounced for smaller banks than for systemically important banks, since the latter have higher shares of demand deposits.

Figure 5. Asset Quality and Return on Equity

Non-Performing Loans
(Percent of outstanding loans)

Source: Financial Soundness Indicators Database, IMF; European Central Bank; and Haver Analytics.

Provisions and Non-Performing Loans
(LHS - Mil. Euros; RHS - Percent)

Sources: Financial Soundness Indicators Database, IMF; and IMF staff calculations.

Non-Performing Loan Ratios by Sector
(in percent)

Sources: European Banking Authority; and Haver Analytics.

Interest Income and Expenses
(in percent of total assets)

Sources: European Central Bank; and Haver Analytics.

Return on Equity
(Percent of assets)

Sources: European Central Bank; and Haver Analytics.

Deposit Structure
(in percent; measured as a share of total)

Sources: Bank of Estonia; Haver Analytics; and IMF staff calculations.

C.   Capital Adequacy

12.   Despite remaining high, capital adequacy of Estonian banks has been steadily declining over time. The Common Equity Tier 1 (CET1) ratio has exhibited a notable downward trajectory, falling from over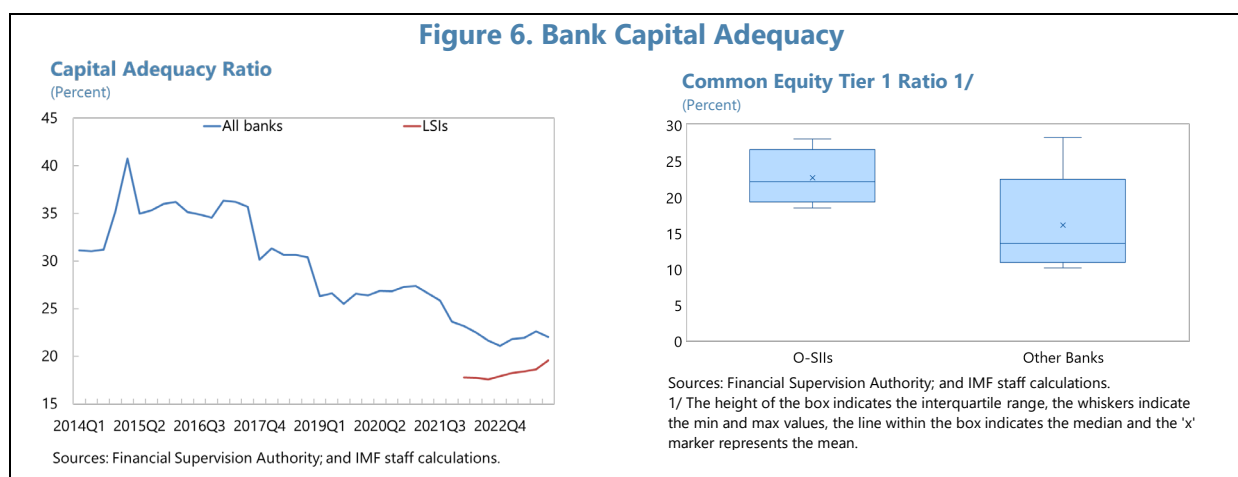 40 percent in 2014 to 21.5 percent recently (Figure 6). This decline can be attributed to several factors, including growing bank leverage and the expansion of banks' loan

portfolios. Additionally, reforms to corporate taxation have incentivized banks to prioritize dividend payouts over profit retention, further impacting capital ratios.[5]

13.   Supervisory measures aimed at ensuring fair treatment of risk exposures across banks have also contributed to the observed decline in banks' capital ratios in the most recent period. Analysis of bank-level balance sheet data reveals that the significant drop in the aggregate capital adequacy ratio since 2021 has been primarily driven by the decline of the CET1 ratio of Swedbank. In turn, the substantial increase in Swedbank's risk-weighted assets was the main factor underlying the decline in the bank's capital adequacy ratio. A similar pattern was observed for SEB, albeit to a lesser degree. In contrast, the CET1 ratio of Luminor remained broadly stable during the period, and that of LHV increased slightly.

Figure 6. Bank Capital Adequacy

Capital Adequacy Ratio (Percent)

Common Equity Tier 1 Ratio 1/ (Percent)

Sources: Financial Supervision Authority; and IMF staff calculations.

Sources: Financial Supervision Authority; and IMF staff calculations.
1/ The height of the box indicates the interquartile range, the whiskers indicate the min and max values, the line within the box indicates the median and the 'x' marker represents the mean.

D. Heterogeneity of Capital Levels Across Banks

14.   Small banks are, on aggregate, less capitalized than large banks. Examination of capital distribution among banks shows considerable variation in capital adequacy across systemically important banks and other banks. The capital adequacy ratio for the non-systemically important banks is about 4 percentage points lower than the average (Figure 6).

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[5] The Estonian income tax system introduced in the early 2000s, under which profits are only taxed when dividends are paid out, encouraged banks to hold on to their profits rather than distributing them, which increased equity. The lowering of the corporate income tax rate on regularly-distributed dividends from 20 percent to 14 percent starting from 2019 and the requirement for Estonian banks to make quarterly advance payments of corporate income tax at 14 percent from the profits earned in previous quarter, which could be offset against the income tax paid on regular dividend payments, created incentives for some banks to distribute their profits and reduce their equity, see IMF (2021) and Eesti Pank (2023b). Furthermore, the 14 percent preferential rate on banks—which, unlike the corporate income tax on non-financial corporations, is levied on entire profits through quarterly advances as opposed to distributed profits—will be raised to 18 percent from 2025, possibly further incentivizing dividend distribution (see IMF, 2023, Box 1).

15.   The capital adequacy ratio differs significantly across smaller banks as well. For instance, the CET1 ratio of smaller banks ranges between 10.1 and 28.2 percent and the median is significantly lower than for O-SIIs (Figure 6).

E.   Risk Weights on Mortgage and Corporate Lending at IRB Banks: A Counterfactual Analysis

16.   The high capital adequacy ratios of some Estonian banks partly stem from their relatively low risk-weighted assets. This is largely due to the implementation of the Internal Ratings-Based (IRB) approach for certain segments of their loan portfolios, resulting in lower risk charges and capital requirements for credit risk. In this section, we employ a counterfactual exercise to illustrate how IRB methodologies may result in lower risk weights and higher capital ratios.

17.   Two Estonian O-SII banks utilize IRB methodologies to assess the risk weights of two main asset categories in their lending portfolios: i) mortgage loans on residential real estate (RRE) to households, and ii) lending to NFCs. These two banks account for about three quarters of the total stock of housing loans in Estonia and about one third of the stock of NFC lending.

18.   The risk weights, determined by internal models, incorporate historical loss experiences in housing loans and NFC lending. Given the favorable borrowing environment in Estonia, characterized by declining shares of overdue and non-performing loans in recent years, the average IRB-based risk weights have shown a systematic downward trend. While these risk weights may be associated with more prudent lending practices relative to those of banks which do not adopt IRB-based risk weights, they may also not fully reflect the riskiness of the underlying exposures in the current economic downturn. However, this analysis does not assess the riskiness of the loan books of banks.

19.   Following a steady decline in the RW applied to RRE exposure by IRB banks, Eesti Pank introduced a 15 percent floor on the average risk weights for mortgage loans in September 2019. However, no such floor currently exists for IRB-based risk weights for NFC loans.

20.   Risk weight floors are applied in several Nordic countries, and they tend to be higher than in Estonia. For instance, Sweden has set risk weight floors at 25 percent for mortgage exposures on RRE and 35 percent for commercial real estate since 2013. The Netherlands applies a variable floor to risk weights for RRE, which differentiates the RW based on the loan-to-value (LTV) of the mortgage. The RW of the individual loan increases from 12 percent for a loan with an LTV ratio of less than 55 percent up to 26.85 percent for a loan with an LTV ratio of 100 percent. As a further comparison, the standard methodology, applied by non-IRB banks in Estonia, imposes a risk weight of 35 percent to RRE exposures.

21.   Information on the size of banking books under IRB and the risk weights used is not readily available. However, with some assumptions based on evidence from banks' financial accounts, we can infer that these segments constitute a significant portion of the two IRB banks' lending portfolios (Figure 7).

Figure 7. Estimated Share of Banking Book Under Standardized and IRB Approach

Sources: Financial Supervision Authority; and IMF staff calculations.

Sources: Financial Supervision Authority; and IMF staff calculations.
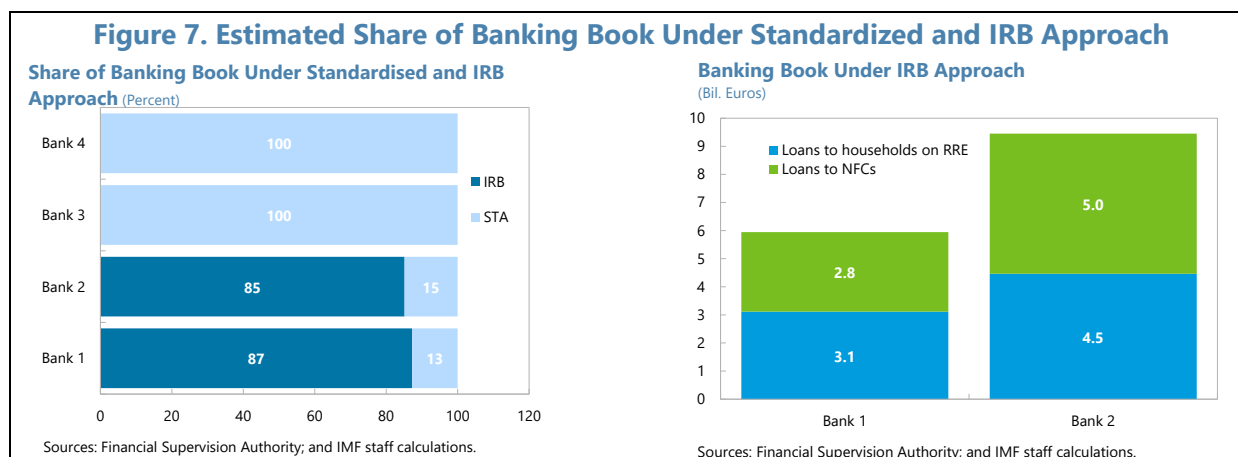
22.   Using a similar approach, we can approximate the magnitude of the risk weights utilized by the two IRB banks. These estimates can then be compared with those derived from a parallel analysis conducted by Kask, Kosenko, and Raudsaar (2024; henceforth KKR, 2024). For mortgage loans, our estimated average IRB-based risk weights exceed those obtained in KKR (22 percent compared to 15 percent).[6] Conversely, for NFC loans, our average IRB-based risk weights are somewhat lower than KKR (74 percent versus 65 percent), but we obtain comparable system-wide averages for risk weights under the standardized approach (see Table).

	Risk Weights (Percent)			
	IRB banks		**Standardised approach**	
	KKR (2024)	IMF staff estimate	KKR (2024)	IMF staff estimate
Mortgage loans	15	22	35	35
NFC loans	74	65	86	85
Sources: Kask, Kosenko, and Raudsaar (2024); and IMF staff calculations.				

23.   We run two counterfactual exercises to simulate the impacts of greater equalization of risk weights among Estonian banks.

24.   The first exercise explores the effects of imposing a 35 percent floor on mortgage loans for the two IRB banks. This would increase the risk weights and reduce the capital ratios by 113bps and 153bps for Bank 1 and Bank 2, respectively. At the systemic level, this change would result in a 67bps decrease in the overall capital ratio (Figure 8).

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[6] In KKR (2024), the starting point for mortgage loans is the regulation, as the focus of the analysis is on pricing of a new loan. As such, the risk weights of 15 percent for IRB banks and 35 percent under the Standardized approach are not fully comparable with those employed in this study, which are estimated system averages. For NFC loans, the risk weights are system averages in both studies.
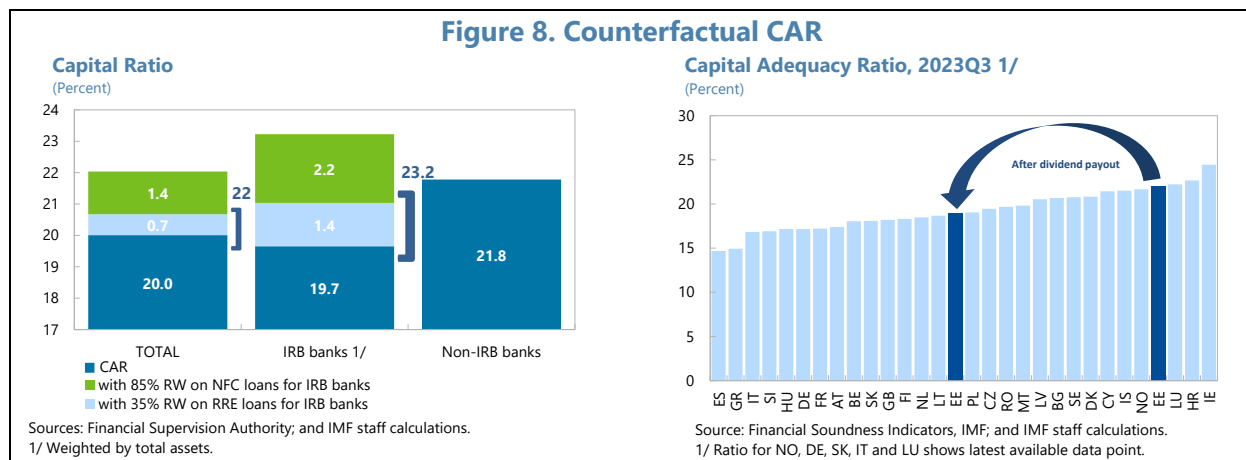
25. **The second exercise considers the impact of a higher risk weight to NFC loans provided by IRB banks.** Since there is no regulatory floor for such exposures, we consider the impact on banks' capital ratios that results from bringing the IRB risk weights on NFC loans in line with the average of the Estonian banking system. It is worth noting that while the assumed 85 percent ratio for calibration broadly matches Bank 1's estimated IRB-based risk weight on this portfolio segment (83 percent), it significantly exceeds our estimate of Bank 2's IRB-based risk weight, which stands at approximately 55 percent.

26. **The resulting capital charges would be significant**, given the existing gap in risk weights (Figure 8). For the system as a whole, the impact would be a 144bps reduction in the capital ratio. The combined effect of the two exercises, presented in Figure 8, shows that adopting more conservative risk weights for these two categories of bank lending would lower the overall capital adequacy ratio of the banking system by approximately 200bps, from 22 percent currently, to 20 percent.

F. Taxation of Extra Profits

27. **Several EU countries have implemented new taxes on banks' extra profits or have raised the tax rates on existing taxes.** There is significant heterogeneity across countries in the tax design. The Baltic economies stand out in contrast to the rest of the EU, because of the significantly higher impact of the bank tax on banks' capital adequacy for a given level of fiscal revenues.

28. **In Estonia, no direct tax has been levied on bank profits.** However, a large taxable, one-off dividend payout, on top of the ordinary annual dividend distribution, is expected to temporarily support government's fiscal revenue but further reduce bank capital ratios by 3 percentage points (Figure 8).[7] The combined effect of the higher calibrated risk weights and the dividend payout would significantly reduce Estonian banks' capital headroom. An important caveat is that the dividend payout is not exogenous to the capital ratios, and it may have not occurred had the risk weights been higher and the capital ratios lower.

Figure 8. Counterfactual CAR

Sources: Financial Supervision Authority; and IMF staff calculations.
1/ Weighted by total assets.

Source: Financial Soundness Indicators, IMF; and IMF staff calculations.
1/ Ratio for NO, DE, SK, IT and LU shows latest available data point.

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[7] For the estimate, it is assumed that the full payout would have accrued to capital, if not paid as dividend.

G.   Conclusions and Recommendations

29.   Despite facing a challenging macroeconomic environment, Estonian banks have remained resilient, maintaining soundness throughout. While capital levels have remained adequate, there has been a gradual decline in capital adequacy in recent years and solvency ratios exhibit significant variation across different banks. Mirroring global trends, Estonian banks achieved record profits in 2023, with Non-Performing Loan (NPL) ratios remaining low despite higher interest rates.

30.   Reliance on Internal Ratings-Based (IRB) models has historically resulted in lower risk weights and higher capital ratios. A 15 percent floor on average risk weights for mortgage loans, introduced by the authorities in 2019 is lower than those in some Nordic countries with equally dynamic property markets. Additionally, the floor is notably lower than the risk weight from the standardized methodology, employed by the rest of the banking system. A recent large one-off dividend payout is expected to bolster fiscal revenue while further diminishing bank capital ratios by an estimated 3 percentage points.

31.   In light of these developments, the resilience of the banking sector can be enhanced in several ways. First, taxes on windfall profits or initiatives encouraging higher taxable dividend payouts should be avoided, acknowledging the cyclical nature of the current upswing in bank profits and the pivotal role they play in bolstering capital buffers, particularly during periods of economic downturn. Second, bank exposures should be reviewed to ensure that credit risk is properly reflected in risk weights across the banking system. Finally, building on recent progress there is scope for reviewing macro- and micro-prudential requirements for less significant institutions, ensuring that current regulations promote financial stability uniformly across the banking sector.

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POLICIES TO TACKLE CLIMATE CHANGE IN ESTONIA[1]

Despite substantial progress in reducing its carbon footprint, Estonia remains one of the most emission-intensive economies in the EU. Heavy reliance on oil shale for energy and electricity generation, a low effective carbon price, and high (explicit and implicit) fossil fuel subsidies are key hurdles to decarbonization. Phasing out oil shale production as planned is essential for achieving the green transition. Further increasing the share of renewables in electricity generation, removing red tapes to the deployment of renewable sources, and improving the interconnectivity of the electricity grid will support greening the energy mix. Complementing this, ambitious actions on carbon pricing, energy efficiency, and reducing fossil fuel subsidies are necessary. Targeted sectoral policies in the residential and transportation sectors, which produce the most GHG emissions after electricity generation, may provide additional support to the transition.

A. Background

1.   Estonia's carbon footprint improved significantly in the early 1990s, but progress has stagnated since then. Estonia's Greenhouse Gas (GHG) emissions declined sharply in the years immediately after regaining independence, as the country transitioned from a planned economy to a market economy and modernized its industrial base. However, this improvement was short-lived, and was quickly followed by a prolonged period during which emissions remained broadly stable (Figure 1).

2.   Emissions fell moderately in wake of the GFC in 2008. This improvement came mainly on the back of the sharp contraction in economic activity which followed the crisis and was quickly reversed in subsequent years.

3.   A further fall in emissions was recorded after 2018. This reflected EU green transition policies and rising CO2 prices but also the effects of COVID-19 on economic activity. These latter gains were partly reversed as pandemic-related restrictions to mobility and economic activity were lifted in 2021. In 2022, emissions are estimated to have further rebounded, as Estonia increasingly relied on oil shale for electricity production, following Russia's war on Ukraine and the subsequent sharp increase in energy prices.

4.   Over the past two decades, emissions have largely decoupled from economic activity. This is shown by the 'Kaya identity', which decomposes emissions into contributions from demographic, economic and energy factors:

$$GHG\ emissions = Population\ \times \frac{GDP}{Population} \times \frac{Energy\ consumed}{GDP} \times \frac{GHG\ emissions}{Energy\ consumed}$$

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[1] Prepared by Gianluigi Ferrucci and Sadhna Naik.

According to this identity, the dynamics of Estonia's GHG emissions during the past two decades reflect diverging patterns between per capita GDP, which grew strongly over the period adding to emissions, and improved energy efficiency and emissions intensity, which exerted downward pressure on emissions. Of these two factors, the main contribution to the decoupling came from an accelerated decline in the energy intensity of GDP (see Figure 1):
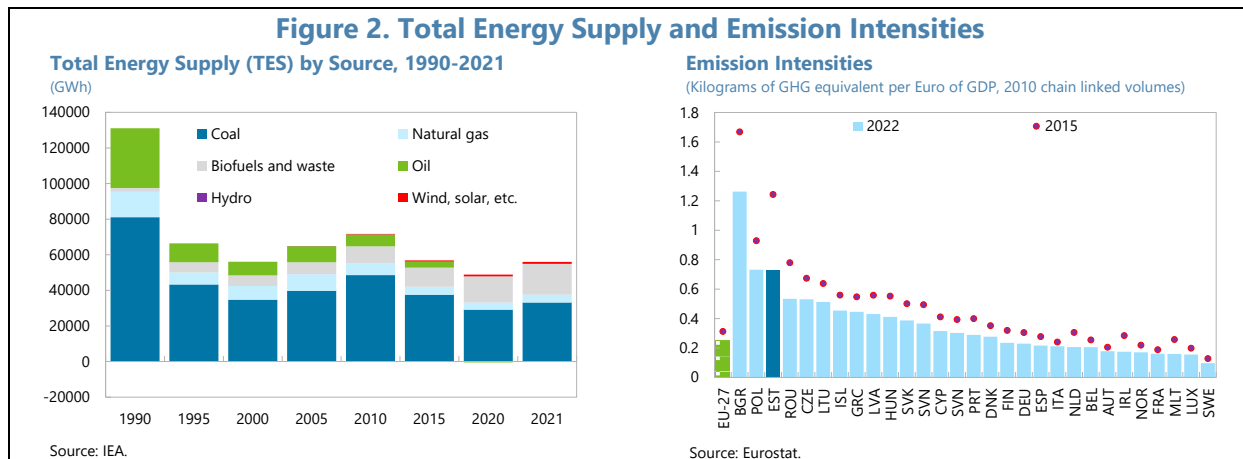

Figure 1. Reported Emissions and Kaya Decomposition

Sources: UNCC; and IMF staff calculations.

Sources: Global Carbon Project; World Bank; Our World in Data; and IMF staff calculations.
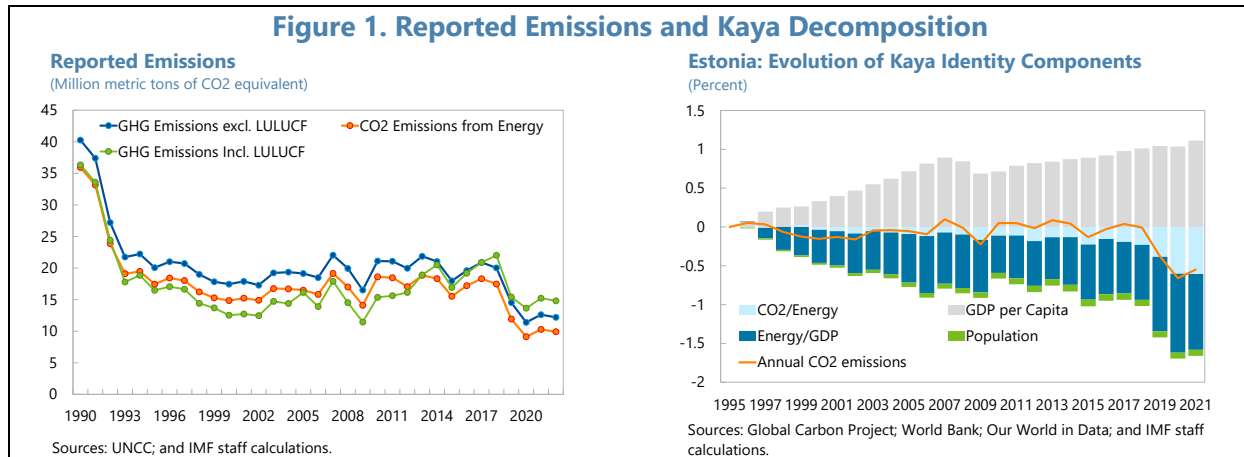
5.   Estonia's carbon-intensive energy mix is a key obstacle to decarbonization. While the energy intensity of output has come down significantly in the past two decades—similar to the EU average—the emission intensity of energy is high and has fallen only moderately. This is because Estonia relies on oil shale for about 60 percent of its energy supply and oil shale has a high carbon emission factor (Figure 2).

6.   Lack of connections to Europe's main electricity grids has prevented Estonia from fully diversifying its energy mix so far. Estonia is one of the few remaining EU member states, together with Latvia and Lithuania, with electricity networks that are still synchronized with Russia and Belarus. The interconnector project, which is supported by the EU and aims at connecting the electricity networks of the three Baltic States with continental Europe via Poland by February 2025, will ease some of these constraints.

7.   Investments to greening dispatchable generation are ongoing. Currently the dispatchable generation is provided mainly from oil shale and biomass powerplants, which are CO2 intensive and aging. Further, biomass usage for large scale energy production is controversial. At current trends in electricity demand, the authorities foresee a lack of dispatchable capacity already in 2027. They have identified the need for an additional reserve capacity mechanism by that date, for which state-aid permission has already been requested from the EU. Future choices for additional dispatchable generation capacity include gas and nuclear (Small Modular Reactors).

8.   Estonia remains one of the most carbon-intensive economies in the EU. Reflecting the country's inefficient energy mix and its heavy reliance on oil shale in energy production, Estonia's carbon emission per unit of GDP is the second highest in Europe, after Bulgaria and on par with Poland (Figure 2).

Figure 2. Total Energy Supply and Emission Intensities

Total Energy Supply (TES) by Source, 1990-2021

Emission Intensities

Source: IEA.

Source: Eurostat.

9.   Current and planned measures are expected to support decarbonization going forward. The Estonian government has set itself the aim to achieve climate neutrality by 2050, in line with EU objectives, with an interim target to cut GHG emissions by 80 percent by 2035, compared with 1990 levels. Estonia has already reduced its GHG emissions by about 42 percent since 2010 and has committed to phase out oil shale in power generation by 2035. However, at current policies, the goal to achieve climate neutrality by 2050 is largely out of reach, absent a deep restructuring of the country's energy mix (Figure 3).

Figure 3. Emissions Forecast

Historical and Projected GHG Emission (2023-2050)
(Mil. ton CO2 equivalent)

Sources: Ministry of Climate of Estonia; EDGAR and European Environment Agency.

B.   Mitigation Policies

10.   Estonia's ambitious climate goals require actions on various fronts. This section discusses several policy tools that policymakers could activate to address Estonia's energy sector challenges and drive a clean, secure and just energy transition that maintains energy affordability and supports economic development in the oil shale region.
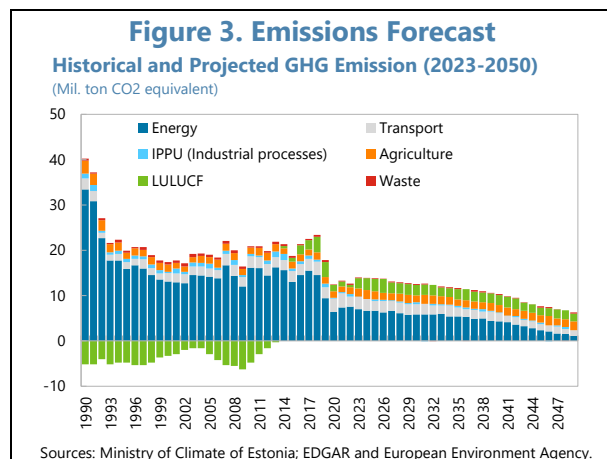
11.   Gradually raising carbon prices is a key tool for climate mitigation. Raising the price of carbon to account for environmental externalities is the most environmentally effective and economically efficient approach to mitigation. The effective coverage of the EU Emission Trading System (ETS) in Estonia is low (Figure 4). As a result, the carbon price effectively paid by Estonian establishments is one of the lowest in the EU, as the carbon price is weighted by the emissions effectively covered by the ETS. Tightening the emission cap and increasing the carbon price will thus be key to help Estonia achieve its carbon reduction targets and climate neutrality by 2050 (Figure 4).

Figure 4. Carbon Pricing Coverage of EU ETS and Effective Carbon Price

Carbon Pricing Coverage in European Countries, 2022
(Share of country total CO2 emissions excl. LULUCF)

Sources: IMF staff calculations based on Dolphin and Xiahou (2022).

Average and Maximum Carbon Price in European Countries, 2022 (in 2021 USD per ton of CO2)

Source: IMF staff calculations based on Dolphin and Xiahou (2022).

12.   **Reducing fossil fuel subsidies would be important to support decarbonization while limiting distortions penalizing greener technologies.** Estonia provides relatively high fossil fuel subsidies (Figure 5). Fossil fuel subsidies may be of two types:

- *explicit subsidies*, which occur when the retail price of a fossil fuel falls below the fuel's supply cost; and

- *implicit subsidies*, which occur when the retail price fails to internalize the externality cost of emissions, or the social cost of carbon, and other congestion costs.

Explicit subsidies tend to be less frequent in advanced economies, although some examples can be identified in Estonia.[2] Implicit subsidies depend on the country's energy mix and energy

Figure 5. Fossil Fuel Subsidies

Fossil Fuel Subsidies, 2021
(Percent of GDP)

Source: IMF staff calculations.

efficiency. In Estonia, the most notable example of implicit subsidy is the undercharging of oil shale producers for their pollution level and the disposal of their production waste. Reducing high fossil fuel subsidies would require reforming explicit subsidies and setting pollution charges that more effectively reflect the environmental damage for society.
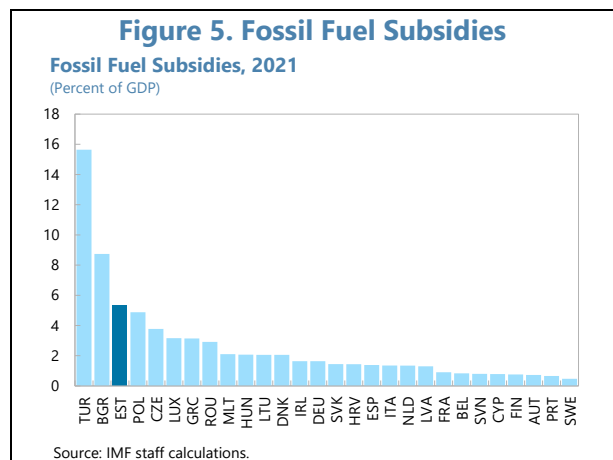
13.   **Gradually phasing out oil shale production as planned is essential for achieving the green transition.** The use of oil shale has declined, but it is still Estonia's largest energy source. Oil shale production carries significant environmental costs. It is one of the most carbon-intensive forms

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[2] Notable examples include: the energy tax relief for companies in agriculture and forestry for gas oil, the reduced energy tax rate for light fuel oil used in mobile machinery, the excise duty exemptions on diesel used for agricultural, fishing, aquaculture and navigation purposes and the excise tax exemption and tax relief for natural gas for industrial consumers. See European Commission (2023), COMMISSION STAFF WORKING DOCUMENT 2023 Country Report - Estonia Accompanying the document Recommendation for a COUNCIL RECOMMENDATION on the 2023 National Reform Programme of Estonia and delivering a Council opinion on the 2023 Stability Programme of Estonia, SWD/2023/606 final, available here.

of electricity and heat generation, and of oil production. It generates substantial amounts of solid waste, contributes to air pollution, and requires extensive water usage. The authorities have committed to end oil shale use in electricity production by 2035 and in all energy production by 2040. However, these targets have not been made binding by law, raising the risk of policy reversal in the future. Moreover, a large part of the oil shale sector is concentrated in Ida-Virumaa, a region in the north-east of the country along the border with Russia. Plans to phase out oil shale will have a significant economic impact on this region, which relies on oil shale for 40 percent of its GDP (OECD, 2024). The authorities aim to reduce this impact through a Territorial Just Transition Plan that is supported with EUR 354 million funding from the EU. This funding is used for investments in renewable energy and the reskilling of local workers. This is important to contain regional disparities, prevent an increase in poverty and ensure broader societal buy-in for the green transition.
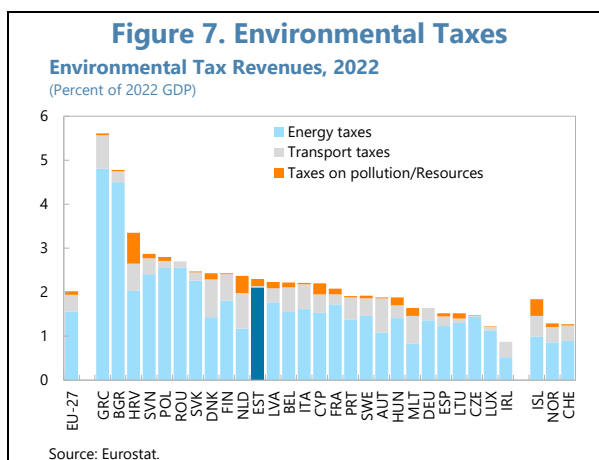
14.   Greening Estonia's energy mix will require a significant increase in the share of renewable sources while penalizing the use of oil shale in energy production. Estonia has made significant strides in developing its renewable energy sector, particularly in wind and biomass energy. The share of renewables in energy consumption has risen significantly since 2010, reaching almost 40 percent of total in 2022 (Figure 6). Building on this progress, increased investment in renewable energy infrastructure and technology could further reduce reliance on

Figure 6. Renewable Energy

Share of Renewable Energy in Gross Final Energy Consumption (Percent)

Sources: Eurostat; and IMF staff calculations.

fossil fuels and drive down emissions. Moreover, prioritizing renewable energy sources would enhance energy security by diversifying the energy mix and reducing vulnerability to supply disruptions. Targeted subsidies, fast tracking of investment in wind and solar power generation, investment in grid integration, storage and dispatchable generation are also necessary to support the EU ETS in greening Estonia's energy mix.
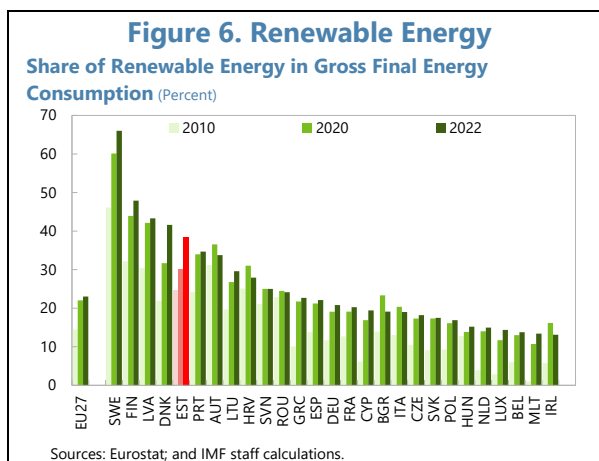
15.   To accelerate decarbonization efforts, Estonia could implement taxation and spending policies aimed at incentivizing emissions reduction and supporting the transition to a low-carbon economy. This could include measures such as carbon taxes, subsidies for renewable energy projects, and incentives for energy-efficient practices. While Estonia is broadly in line with the EU average for collection of environmental tax revenues, the transport tax component stands significantly below that of its

Figure 7. Environmental Taxes

Environmental Tax Revenues, 2022
(Percent of 2022 GDP)

- Energy taxes
- Transport taxes
- Taxes on pollution/Resources

Source: Eurostat.

EU peers, and the EU average, mainly reflecting the lack of a car tax (Figure 7). Estonia's high

emissions from the transport sector owes in large part to its relatively energy-inefficient car fleet. While this this is not necessarily related to the lack of a car tax, a car tax could be designed in a way to guide an accelerated improvement of the emission intensity of the existing car stock over time.
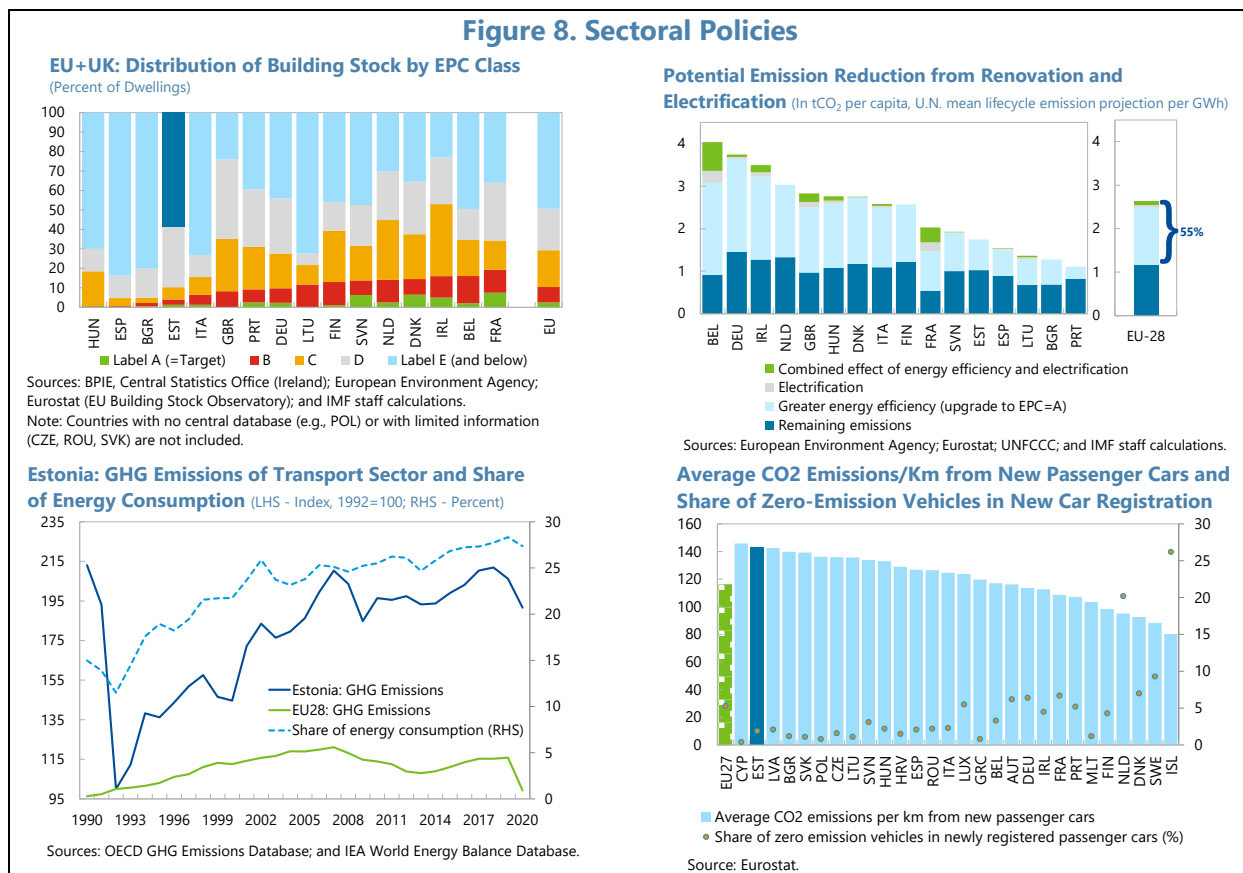
C. Sectoral Policies

16.   Targeted sectoral policies can complement carbon pricing. Together with the power and heat generation sector discussed above, residential, and commercial, as well as road transport are the other two economic sectors producing most GHG emissions in Estonia. Mitigation policies in these sectors, in the form of regulation, standard setting, and taxes for polluting activities and incentives for clean activities could support a faster transition to net zero.

17.   A more fuel-efficient vehicle fleet could support reducing emissions in the transport sector. GHG emissions in the transport sector have increased steadily since the early 1990s, driven by road transport. The increase in the number of vehicles—mostly passenger cars—and kilometers driven over time, which has been a key factor explaining the increase in emissions in the sector, reflects rising living standards over the past three decades. The high average age of passenger cars in Estonia adds to the problem. Although the emissions of new passenger cars have declined in recent years, the emission efficiency in CO2/km has been below the EU average, mainly reflecting the low share of zero- and low-emission vehicles. A well-calibrated registration and road tax could promote greater vehicle efficiency and reduce emissions generated by the transport sector.

18.   Enhancing energy efficiency in the residential sector will also be key to achieve energy savings targets. Around 90 percent of Estonia's residential housing stock is rated below D on the Energy performance Certificates (EPCs), a rating scheme that summarizes the energy efficiency of buildings in the EU. Reducing buildings' energy demand will thus require accelerating renovations to increase energy efficiency. As a thought experiment, a full upgrade of Estonia's housing stock to the highest energy efficiency standard (EPC=A) would reduce emissions per capita by 42 percent relative to current levels. Considering country-specific retrofitting costs for renovation, energy cost savings would fully repay the investment costs in a shorter time than required on average in the EU, which would justify prioritizing the related investment from an EU-wide perspective.
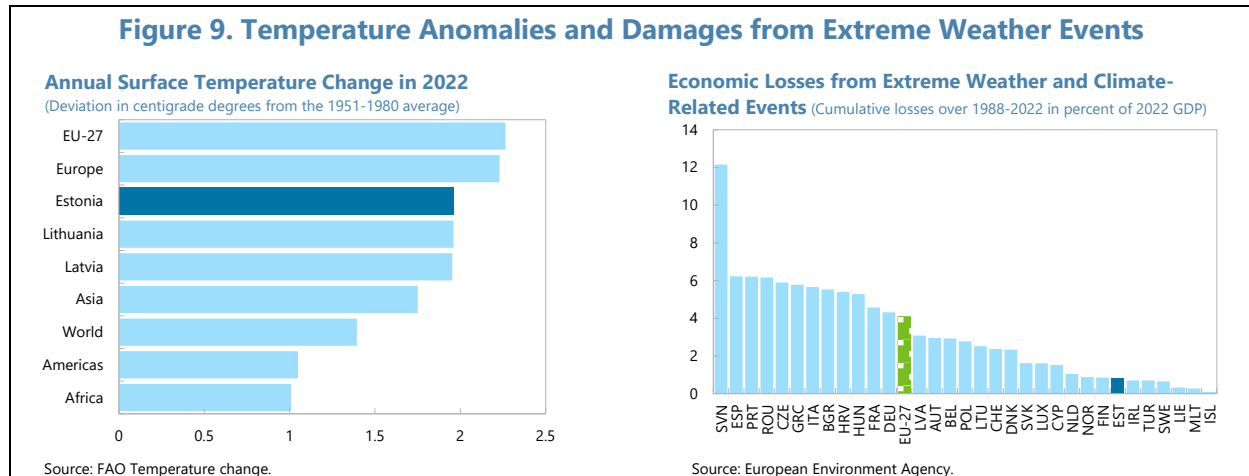
Figure 8. Sectoral Policies

EU+UK: Distribution of Building Stock by EPC Class
(Percent of Dwellings)

Label A (=Target)　B　C　D　Label E (and below)

Sources: BPIE, Central Statistics Office (Ireland); European Environment Agency; Eurostat (EU Building Stock Observatory); and IMF staff calculations.
Note: Countries with no central database (e.g., POL) or with limited information (CZE, ROU, SVK) are not included.

Potential Emission Reduction from Renovation and Electrification (In tCO$_2$ per capita, U.N. mean lifecycle emission projection per GWh)

Combined effect of energy efficiency and electrification
Electrification
Greater energy efficiency (upgrade to EPC=A)
Remaining emissions

Sources: European Environment Agency; Eurostat; UNFCCC; and IMF staff calculations.

Estonia: GHG Emissions of Transport Sector and Share of Energy Consumption (LHS - Index, 1992=100; RHS - Percent)

Estonia: GHG Emissions
EU28: GHG Emissions
Share of energy consumption (RHS)

Sources: OECD GHG Emissions Database; and IEA World Energy Balance Database.

Average CO2 Emissions/Km from New Passenger Cars and Share of Zero-Emission Vehicles in New Car Registration

Average CO2 emissions per km from new passenger cars
Share of zero emission vehicles in newly registered passenger cars (%)

Source: Eurostat.

D. Physical Risk and Adaptation Policies

19.   Despite significant warming trend, damages from extreme weather events have been relatively contained in Estonia so far. Estonia has experienced a faster temperature rise than the world average, with steady decline in winter ice and snow coverage. However, cumulated losses from extreme weather events have remained contained so far, at less than 1 percent of 2020 GDP over the period 1980-2020, against an EU average of around 3.5 percent of GDP (Figure 9). Estonia's geographic location and climate characteristics contribute to its resilience against extreme weather events. Additionally, investments in infrastructure and disaster preparedness, as well as the country's advanced economy status, have bolstered its capacity to withstand and respond to climate hazards.

20.   Estonia's overall limited exposure to physical risk is supported by various comprehensive, forward-looking metrics. According to the IMF-Adapted ND-GAIN Country Index, a commonly used score of a country's vulnerability to climate-related natural disasters and its preparedness to deal with the consequences of such disasters, Estonia ranks in the upper quartile of the distribution of 182 countries globally, together with most EU peers. This high ranking reflects the country's relatively contained vulnerability to natural disasters due to its geographical position and its high readiness to deal with the consequences of such disasters, as it is generally the case for advanced economies. The INFORM index, a more forward-looking score which assesses the climate

risk exposure of a country under several known warming scenarios, suggests that Estonia's vulnerability will remain unchanged even under more extreme warming scenarios.

Figure 9. Temperature Anomalies and Damages from Extreme Weather Events

Annual Surface Temperature Change in 2022
(Deviation in centigrade degrees from the 1951-1980 average)

Source: FAO Temperature change.

Economic Losses from Extreme Weather and Climate-Related Events (Cumulative losses over 1988-2022 in percent of 2022 GDP)

Source: European Environment Agency.

21.   Despite its relative resilience, Estonia faces adaptation challenges that require proactive planning and policy interventions. Shifts in precipitation patterns, rising sea levels, and increased frequency of extreme weather events pose risks to infrastructure, the economy, and ecosystems. Ongoing monitoring and evaluation are essential to address emerging threats and vulnerabilities.

Figure 10. IMF-Adapted ND-GAIN

IMF-Adapted ND-GAIN Index, 2021
(Score from 0 to 100, higher is better)

Source: IMF-Adapted ND-GAIN; Findex - The Global Findex Database 2021; Worldwide GovernanceIndicators; and IMF staff calculations.

E.   Conclusions

**22.   Mitigating climate change requires comprehensive and coordinated policies that address barriers such as low effective carbon pricing and high fossil fuel subsidies while leveraging opportunities in renewable energy, taxation, spending, and technology. By adopting these measures, Estonia can accelerate its transition to a sustainable, low-carbon economy while enhancing energy security and fostering long-term economic prosperity. While Estonia may currently exhibit resilience to immediate climate risks, proactive adaptation planning is imperative to address emerging challenges and ensure long-term sustainability.
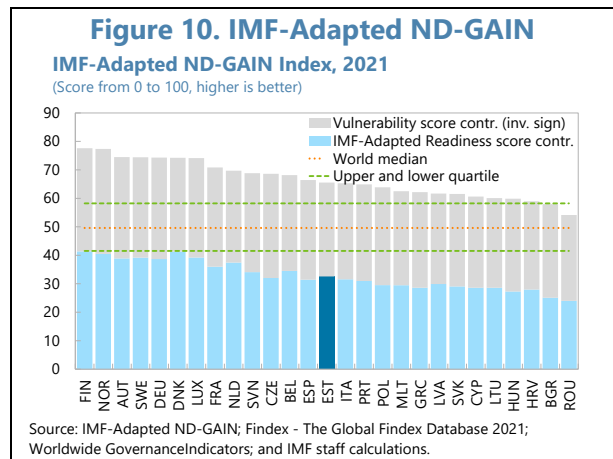
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