INTERNATIONAL MONETARY FUND

REPUBLIC OF NORTH MACEDONIA

SELECTED ISSUES

January 2024

This paper on the Republic of North Macedonia was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed on January 4, 2024.

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SELECTED ISSUES

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Approved By
European Department

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CLIMATE CHANGE—CHALLENGES AND POLICIES[1]

North Macedonia is exposed to climate change and natural hazards that pose substantial risks to public safety and public infrastructure, mainly from flooding and forest fires. North Macedonia has committed to an ambitious climate change mitigation and adaption agenda, reducing GHG emissions by more than 50 percent by 2030 compared to 1990. At the same time, North Macedonia has an aging fossil-fuel based energy generating infrastructure and potentially a large scope for improving energy efficiency. A scale-up of private and public investments, along with decommissioning old and polluting coal-based power plants is needed to meet emissions targets and support the green transition. Finally, North Macedonia will be impacted by the EU-Carbon Border Adjustment Mechanism (EU-CBAM). The authorities should consider a gradual introduction of carbon taxation to prepare for the EU-CBAM, as also envisioned in existing legislation.

A. Introduction

1.   **North Macedonia is exposed to climate change and natural hazards that pose substantial risks to public safety and public infrastructure.** Between 1990 and 2023, flooding events were the most numerous natural hazards and caused the largest damages (see Text Table I). Floods and fires are forecasted to become more frequent and extreme as climate change alters temperatures and climate patterns. The country is highly exposed to river floods and urban flood hazards. Potentially damaging and life-threatening floods are likely to occur at least once in the next 10 years. Rainfall patterns, terrain slope, geology, soil, land cover, and earthquakes lead to high risks of landslides. Wildfires are another area of high risk. Climate change and natural hazards are expected to pose greater risks to North Macedonia in the future.

2.   **North Macedonia has an aging fossil-fuel based energy generating infrastructure and potentially a large scope for improving energy efficiency.** North Macedonia is a relatively energy-intensive economy with a fossil-fuel-dominated energy mix, driving the country's Green House Gas (GHG) emissions. Coal-based electricity generation accounts for 50 percent of total domestic electricity production. The aging coal-fired power plants, some of which from the 1960s, intensive use of inefficient electrical resistance heating devices, and heating stoves on fuelwood and coal, as well as a relatively high pollution from the transport sector, create serious issues with air quality and the overall emissions, as well as scope for greater energy efficiency.

3.   **North Macedonia will be impacted by the introduction of an EU Carbon Border Adjustment Mechanism (CBAM).** From 2026 EU importers of goods originating from outside the EU are required to purchase certificates equivalent to the weekly EU carbon price if the imported goods are not subject to equivalent carbon pricing as the EU ETS. The CBAM initially applies to imports in selected emission-intensive sectors: Cement, Iron and Steel, Aluminum, Fertilizers,

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[1] Prepared by Prepared By Stephen Ayerst, Thomas Gade (both EUR), Arturo Navarro (FAD), and Faton Sulejmani (local IMF office, Skopje)

Hydrogen, and Electricity. North Macedonia will be impacted by the EU CBAM and should consider a form of carbon tax in response and as a tool to incentivize the green transition.

4.   North Macedonia has committed to an ambitious climate change mitigation and adaption agenda. North Macedonia was the first country in the region to adopt a National Energy and Climate plan outlining the path to achieving goals set for 2030. In the enhanced Nationally Determined Contribution (NDC) submitted in 2021 the government committed to reduce GHG emissions by more than 50 percent by 2030 compared to 1990. Under the European Green Deal, as a Western Balkan Contracting Party of the Energy Community, North Macedonia committed to work towards the 2050 climate neutrality target, all while reaching today's GDP per capita levels of neighboring EU countries by 2040.

5.   The investment needs to achieve the government's GHG emission reduction targets are large, and the authorities have an ambitious investment agenda. The authorities have outlined their decarbonization and adaptation plans, including investment needs, in the National Strategy for Energy Development 2020–40, which reflects the most comprehensive document on climate change related measures in North Macedonia. The authorities estimate that the cumulative capital investment needs (public and private) are between €18.5 billion and €34.1 billion through 2050 (30 years), depending on the level of ambition in reducing GHG emissions and strengthen climate resilience. This is equivalent to 4.3–8.0 percent of 2023 GDP annually, and 130–241 percent of GDP cumulative. To cover such large investment needs, would require a strong Public Investment Management (PIM) framework, that also incorporates climate considerations, as well as catalyzing private capital and IFI financing would have to be an essential element.

B.   Exposures to Climate Change and Carbon Emissions[2]

6.   North Macedonia is exposed to climate change and natural hazards which are expected to represent a greater risk in the future. The country's natural hazards assessment indicates high risk to river floods, urban floods, landslides, and wildfire.[3] Potentially damaging and life-threating river and urban floods are expected to occur at least once in the next 10 years. The area has rainfall patterns, terrain slope, geology, soil, land cover and (potentially) earthquakes that lead to high risk of localized landslides. Over a year, there is more than 50 percent probability of experiencing weather conditions which could support a significant wildfire resulting in property and life loss. While extreme heat has so far been a medium risk, at least one prolonged period of exposure to extreme heat is likely to occur with a probability of more than 25 percent in the next five years. Future temperature increases and changes in rainfall patterns due to climate change could further increase likelihood of natural hazards.

7.   North Macedonia has faced several hazards causing damages and endangering public infrastructure. Variable climate, combining higher temperatures and extreme weather events, has

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[2] This section draws on an unpublished IMF Technical Assistance report on C-PIMA, prepared by I. Rial, K. Funke, A. Navarro (all FAD), and K. Cleary (FAD expert).

[3] https://thinkhazard.org/en/report/241-fyr-of-macedonia/

caused hazards including floods and heat waves (see Text Table I). Between 1990 and 2023, flooding events were most numerous (11) and caused the largest damages, totaling USD 644 million. However, the largest impact on the population was caused by forest fires, which affected over one million people.

Table 1. North Macedonia: Natural Disasters in North Macedonia 1990–2023

Natural Hazard 1990–2023	Subtype	Event Count	Total Deaths	Total Affected	Total Damage, Adjusted ('000 USD)
Drought	Drought	1	0	10,000	-
Earthquake	Ground movement	1	0	100	12,194
Extreme temperature	Cold wave	2	16	5,100	-
	Heat wave	2	15	202	-
	Severe winter conditions	2	3	11,020	-
Flood	Riverine flood	9	3	216,311	476,105
	Flash flood	2	29	38,612	168,391
Storm	Convective storm	1	1	3	-
Wildfire	Forest fire	3	2	1,080,000	23,050

Source: EM-DAT—the International Disaster Database contains information on natural disasters in the world from 1900 to present. https://public.emdat.be/

8.   The energy mix of North Macedonia is dominated by fossil fuels, with electricity production driving the country's GHG emissions. Electricity production generates, with around 60 percent, by far the largest share of GHG emissions in North Macedonia, followed by the transport sector, heating sector and agricultural sector with around 10 percent each. Coal-based energy generation, intensive use of inefficient heating stoves on fuelwood and coal, and a high concentration of pollution in the transport sector create serious issues with air quality and the overall emissions, especially during the winter months.

9.   The country has made limited progress in reducing GHG emissions and air pollution. The CO_2 equivalent of the total GHG emission decreased from around 14 thousand kt in 1990 to around 11 thousand in 2020, according to the World Bank's estimates (see Figure I). Even though the country increased domestically produced energy by firing some of the older coal and heavy oil-based generation capacities, the crisis also incentivized and sped up private investments in Renewable Energy Sources (RES) i.e., Photovoltaics (PVs). According to authorities, in the period from January 2022 to September 2023 there were over 450 MW of newly installed and commissioned capacity from PV out of a total of installed electricity generation capacity of 2,266 MW in the country as of end of 2022, while the issued licenses of total approved capacities exceed multiple times the total amounts approved in years. This contributes to the country's strategy on decarbonization, increased share of RES in energy generation and consumption, and the overall NDC goals outlined in the strategies.

C. The Climate Policy Agenda—Targets and Ambitions

10.   North Macedonia has set ambitious GHG reduction targets, led by improvements in the energy sector. In the 2021 Enhanced Nationally Determined contribution, the country committed to reduce GHG emissions by 51 percent and net emissions by 82 percent by 2030 compared to 1990; this implies a reduction in net emissions from 12,271 to 2,203 Gg CO2-eq. Significant reductions of emissions across all economic sectors will be required to achieve this target but efforts will largely be directed at the energy sector, which are expected to fall by as much as 66 percent of the 1990 level complemented by a significant increase in the removals from the FOLU sector (approximately 18 times).[4] Reductions are also expected in agriculture and waste, though not as significant, while emissions from industrial processes would continue to increase with the growing economy (see Figure 1).

Figure 1. GHG Emissions and Drivers of the Reduction

Total GHG Emissions (MtCO2eq)

Total GHG emissions including LUCF

Source: CAIT database through climatewatchdata.com.

Authorities' Projected GHG Reduction by Sector (Gg CO2-eq)

Source: Authorities and IMF staff calculations.
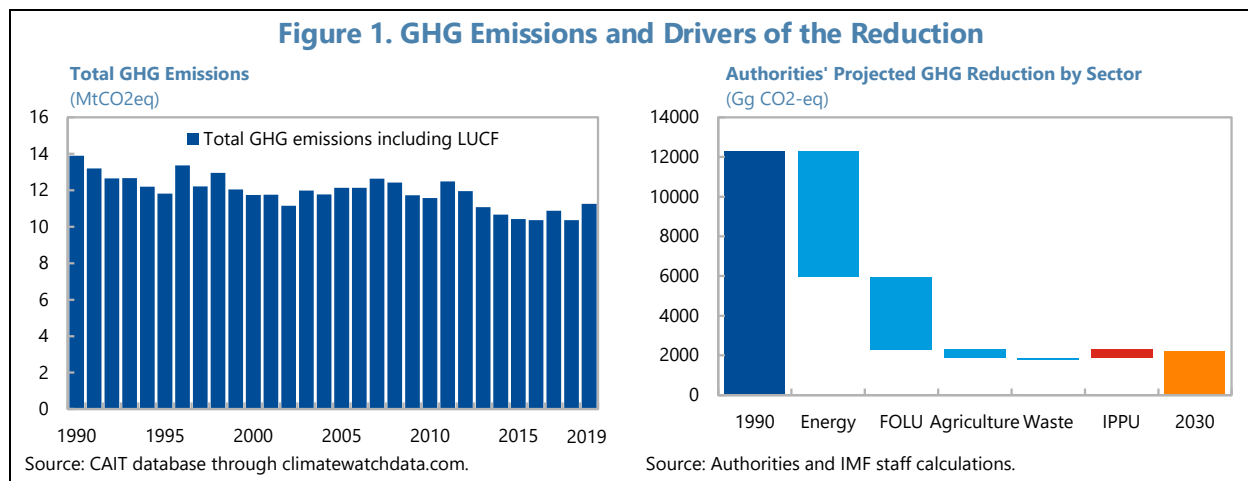
11.   There are national and sectoral strategic documents that provide guidance on North Macedonia's decarbonization plans. The National Strategy for Energy Development 2020–40, adopted in December 2019, envisages a fully integrated internal energy market and aims at providing for a secure, efficient, environmentally friendly, and competitive energy system that is capable to support economic growth. Similarly, the Long-term Strategy on Climate Action and Action Plan sets out the country's mitigation commitments and covers adaptation and mitigation measures through mid-century.

12.   Decarbonization plans are based on plans to increase renewable energy sources in the share of consumed energy. The plan envisages expansion of RES capacities mostly through hydropower plants and PVs, generating 38 percent of gross final energy consumption by 2030. The share in final energy consumption in the electricity sector is foreseen to increase to 66 percent by 2030, whereas the consumption targets from RES in cooling/heating and transport sector stand at 45 percent and 10 percent respectively. The steepest increase is planned to happen in PV, which should be noted that has already seen a significant increase in interest and investments (mostly

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[4] Enhanced Nationally Determined Contributions and Long-term Strategy on Climate Action and Action Plan.

private) since the start of the energy crisis. These assumptions include construction and commissioning of large RES generation capacities such as the hydro-power plant projects Chebren by 2029, Vardar valley in 2025–30, and 120 MW PV power plants in Oslomej as well as more capacities in RES without incentives (solar, wind and biogas). The RES target in the heating/cooling sector assumes electrification of the sector and substitution of the biomass stoves with highly efficient heating appliances.

Figure 2. Renewable Energy Sources Targets and Composition

Renewable Energy Sources' Share in Gross Final Energy Consumption (Percent of Total)

Estimated Trajectory of the Share of RES Technology (Share of Total, Total = 1)

Sources: National Energy and Climate plan

Source: National Energy and Climate plan
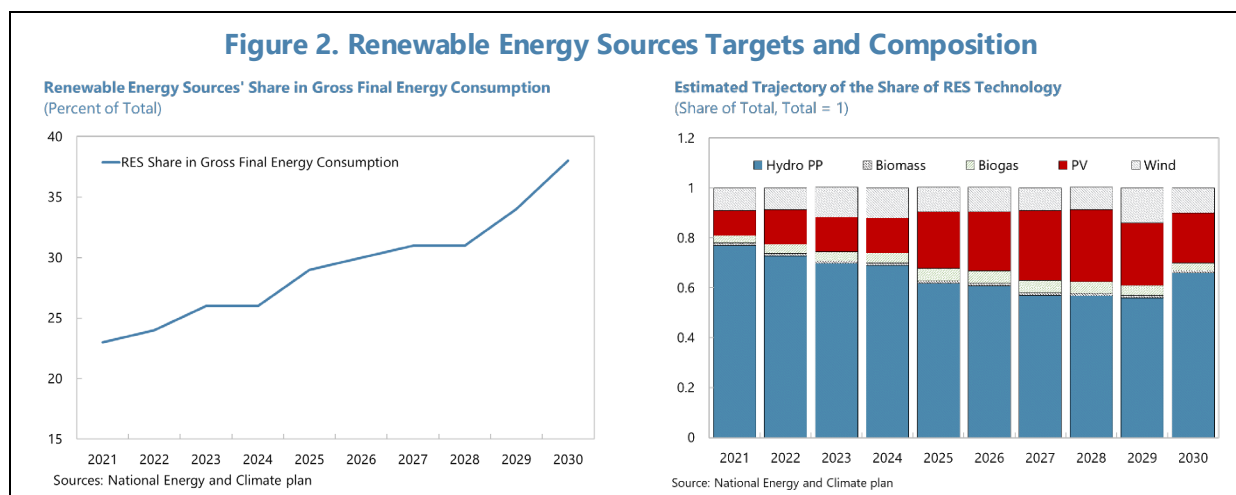
13. **Given limited current generation potential from domestic sources, energy efficiency dimension plays a crucial role in the country context.** NECP lays out a target of 20.8 percent savings of final energy consumption, and 34.5 percent of primary energy consumption savings both relative to the business-as-usual (BAU) scenario. This will be mainly driven by the savings generated in the transport sector planned at 19 percent relative to BAU scenario.

14. **Energy security considerations intend to be accounted for by aiming to limit the import dependency at 59 percent.** This will be conditional on the fulfilling of the plans for installing generation capacities from renewable sources and the energy efficiency targets, given the foreseen increase in demand and the decommissioning of plants. Implementation of such strategy will also support investment in the distribution and transmission networks, strengthening and enabling internal energy market that would facilitate efficient implementation of the RES in the energy system, as well as increase the numbers of prosumers.

D. The Role of the Electricity Sector in the Green Transition[5]

15. **The electricity sector plays an important role in the green transition.** Electricity is consumed both by large firms for production as well as by households and small consumers (small business) for general electricity consumption as well as for heating purposes. The domestic electricity production is predominantly from fossil fuels, mainly coal, but also from hydro power plants, as well as a small share from other renewables such as photovoltaics (see Figure 3). Power

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[5] This section draws on an unpublished Technical Assistance report provided by the IMF on Energy Subsidy Reform, prepared by F. Machado, S. Jahan, D. J. Prady, A. Tumino (all FAD) and T. Gade (EUR).

plants in North Macedonia are aging and inefficient, as well as contributing to particle pollution in the country. GHG emissions from electricity production is around 60 percent of total GHG emissions, according to data from the Ministry of the Environment and Physical Planning, and around 90 percent of that is from using coal as an energy source. The shift from inefficient coal-based power plants to newer power plants, as well as a larger share of electricity produced from renewable sources therefore is an important part of the green transition towards lower GHG emissions and particle pollution.

Figure 3. Characteristics of Electricity Production and Consumption

Electricity Genration by Source
(GWh)

Electricity for Final Consumption
(MWh/month, 3mma)

Sources: ERC and IMF staff calculations.

Sources: Haver Analytics; SSO; and IMF staff calculations.

GHG Emmissions by Sector
(Percent of Total)

Sources: SSO and Ministry of Environment and Physical Planning.
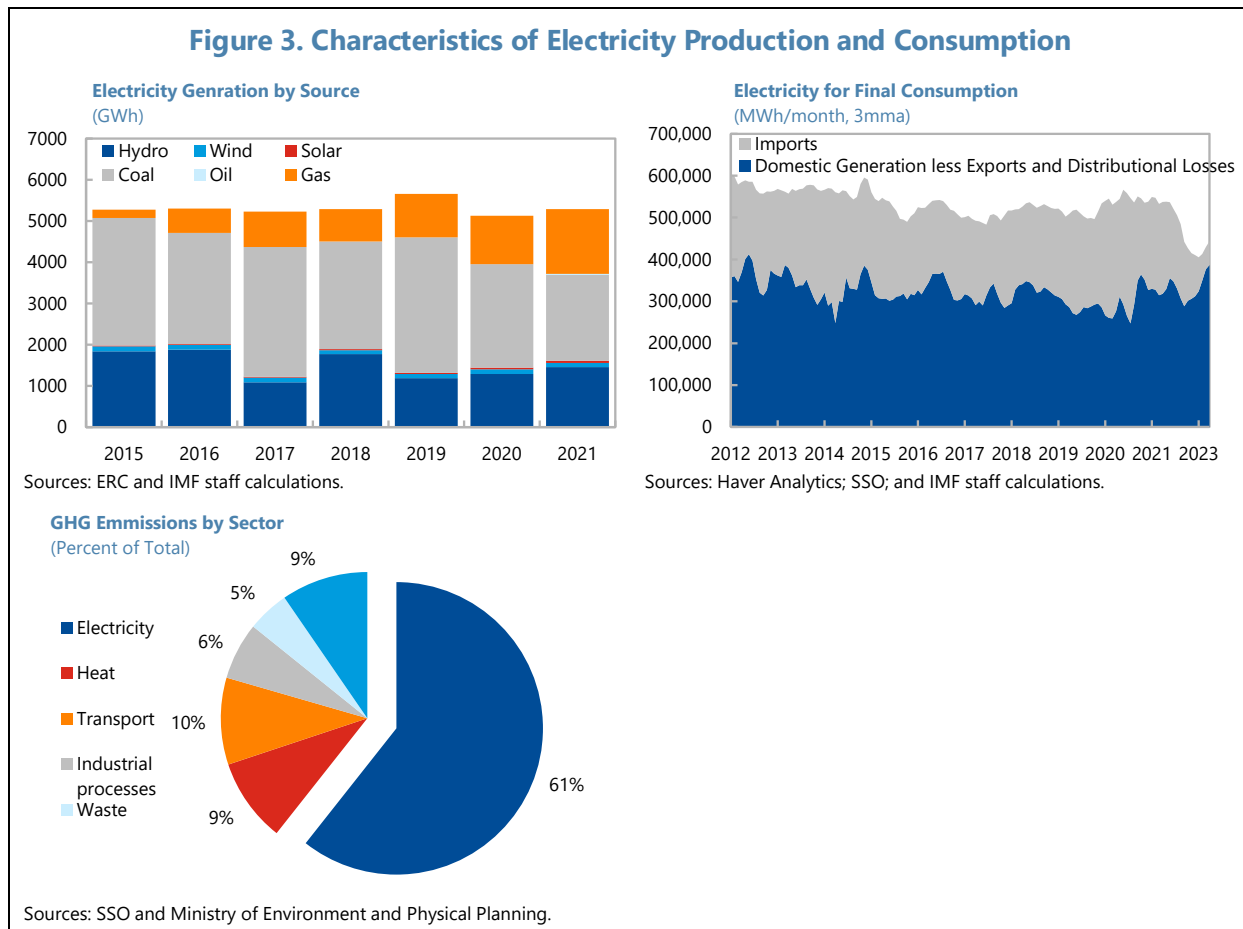
16.   Electricity prices are largely regulated for households and small companies. The electricity market was de-regulated with the 2018 Energy Law, whereby the consumer could freely choose their own supplier of electricity. However, for a transition period, to protect households and small consumers against volatile electricity prices, two markets were allowed to exist: An open market, largely with market pricing, and a regulated market, where households and small consumers would be supplied by a universal supplier and supplier of last resort. During a five-year transition period, the state-owned electricity generator, ESM, was initially intended to cover a gradually shrinking share of the demand of the regulated market, selling electricity to the universal supplier.[6]

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[6] According to the 2018 Energy Law, Article 237, this share would gradually decrease from 100 percent in 2018 (100/2018), 80/2019, 75/2020, 70/2021, 60/2022, 50/2023, 40/2024, to 30 percent in 2025 (30/2025).

The Energy Regulatory Commission (ERC) authorizes tariff increases by the universal supplier to ensure cost recovery in the regulated market, based on reported cost of capital by the regulated entities.[7] However, the state-owned electricity generator, ESM, is not regulated by the ERC, and as it is state-owned, the government allows it to sell electricity at a loss to the universal supplier, thereby subsidizing households (see Figure 4). The Ministry of Finance subsidized electricity prices at a cost of 1.3 percent of GDP in 2022. Staff estimate that electricity subsidies in 2023 will be around 0.8 percent of GDP, while the government adopted measures as part of the policy measures taken under the Precautionary and Liquidity Line (PLL) likely will reduce subsidies in 2024 to 0.3 percent.

Figure 4. Overview of the Electricity Sector
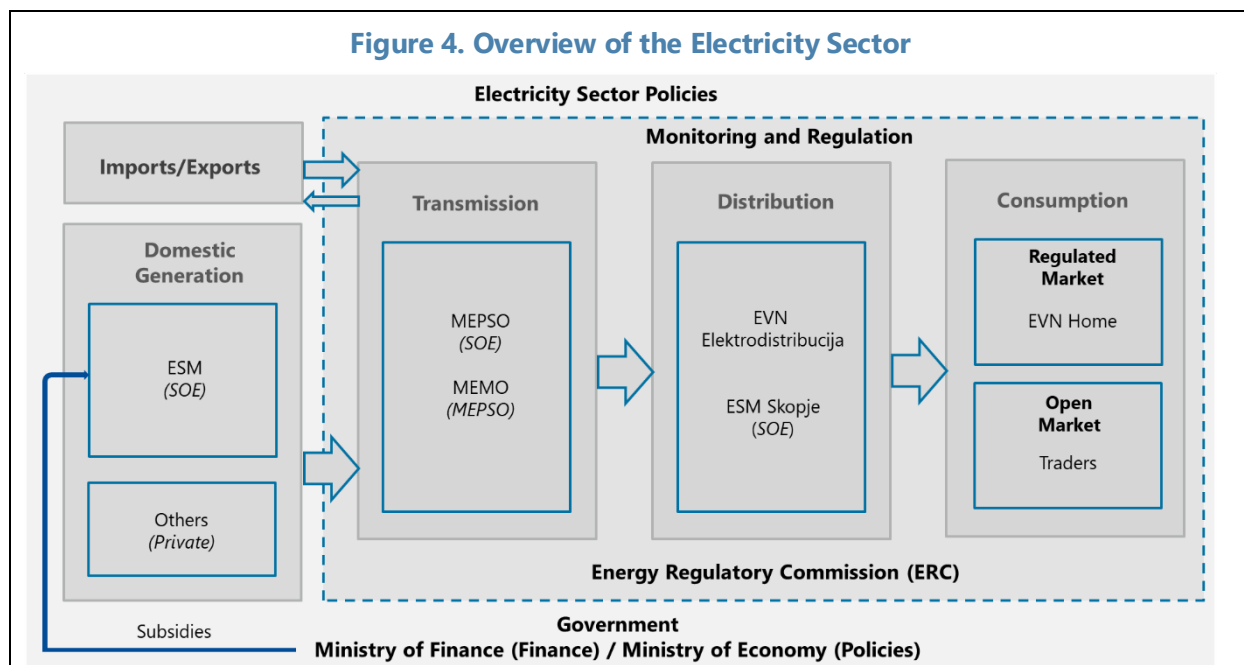
17.   Almost all households and small companies have shifted back into the regulated market for electricity following the price surge in the open market in 2022. In the early years, following the implementation of the 2018 Energy Law, there was a gradual but modest shift of households and small companies from the regulated electricity market to the open electricity market. However, as electricity prices surged in late 2021 and early 2022, households and small consumers that had initially shifted to the open market, moved back to the regulated market. At the same time, as part of the adopted measures to deal with the energy crisis in 2021 and 2022, the state-owned electricity company, ESM, was mandated to cover 100 percent of the electricity demand in the regulated market. As commodity prices as well as the price of imported electricity surged, so did the subsidy, especially to households. Today, most households and small consumers remain in the regulated market, and while electricity tariffs have increased in recent years, the de facto subsidized price remains one of the lowest in Europe for households.

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[7] In addition to the universal supplier, the ERC also regulated the tariffs/network fees for the transmission operators (MEPSO/MEMO) and the distribution operator (Elektrodistribucija).
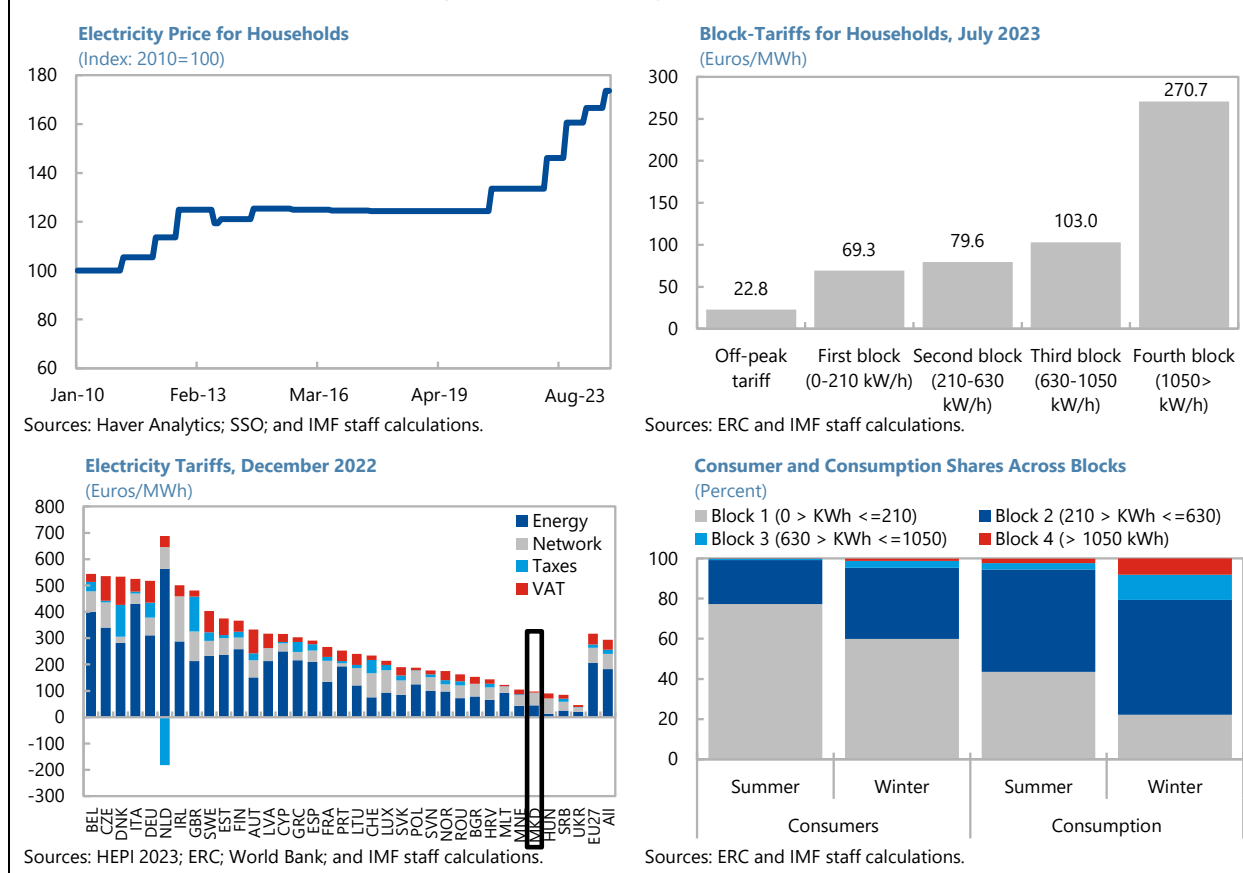
18.   Implementation of electricity block-tariffs in July 2022 was a first step to incentivize lower consumption among high consuming households. The introduction of electricity block-tariffs in the regulated market in July 2022 was a key reform measure to impose a pricing mechanism with a stronger incentive structure, increasingly penalizing high electricity consumption, and thus incentivize lower energy consumption and greater energy efficiency, c.f. Box 1. Nevertheless, the electricity prices for households remain subsidized for a large majority of households. As close to 90 percent of households are consuming in the 1st and 2nd block, as well as almost 50 percent of total electricity consumption among households happens during the very heavily subsidized off-peak tariff, the electricity tariff remains heavily subsidized below both the market price as well as the cost-recovery price of the state-owned electricity generator.

Box 1. Electricity Block Tariffs for Households

The authorities introduced electricity block-tariffs on 1st July 2022, which was a significant reform to incentivize lower electricity consumption among households. The block-tariffs consist of four blocks with marginally increasing tariffs and is applicable during the peak-hours of the day. While the tariff structure was further steepened with the tariff changes on January 1st and July 1st, most households consume electricity in the lower blocks at low tariffs, and electricity prices remain heavily subsidized for most households. The short time span and mild weather makes it difficult to assess the effect of block-tariffs.

- **Introduction of block-tariffs for households during the peak-hours.** With the introduction of block-tariffs in July 2022, the peak-time hours during the day (7 am – 22 pm) became subject to marginally increasing tariffs across four consumption blocks. The blocks were divided into 0–210 kWh/month, 210–630 kWh/month, 630–1050 kWh/month and above 1050 kWh/month. The non-peak hours (22 pm – 7 am) remain subject to a flat and low non-peak tariff. From 1st December, the authorities plan to introduce another two hours of non-peak consumption during the day (1 pm – 3 pm). Small companies are not subject to the block-tariffs and are generally paying a higher tariff than households.

- **Most households consume in the low blocks and during non-peak hours.** As many households use electricity as a heating source, households typically consume more electricity during the cold and darker winter months, than during the summer months. Households consume around 50 percent of their electricity during the non-peak hours and the same share during the peak-hours. On average, during the peak-hours, around 52 percent of electricity consumption lands in block one, while around 43 percent lands in block two. The remaining 5 percent land in block three and four. If looking only at the number of households, the consumption is concentrated even more so in the first and second block.

- **A lower but steeper block-tariff structure from 1st July.** On 1st July 2023, the tariff for the first block was lowered by 9.8 percent to 69.3 €/MWh, the tariff for the second block lowered by 5.1 percent to 79.6 €/MWh, while the tariff for the third block was increased by 4.6 percent to 103 €/MWh and the fourth block by 3.2 percent to 270.7 €/MWh. The non-peak tariff remained broadly stable at 22.8 €/MWh. In addition, there is a flat network fee of 42.7 €/MWh across all blocks. At the same time, the preferential VAT rate was normalized from 10 percent to 18 percent, and the final price of electricity, including VAT, in the regulated market therefore went up for the top-three blocks and the non-peak tariff.

Figure 5. Electricity Block Tariffs

Electricity Price for Households
(Index: 2010=100)

Block-Tariffs for Households, July 2023
(Euros/MWh)

Sources: Haver Analytics; SSO; and IMF staff calculations.

Sources: ERC and IMF staff calculations.

Electricity Tariffs, December 2022
(Euros/MWh)

Sources: HEPI 2023; ERC; World Bank; and IMF staff calculations.

Consumer and Consumption Shares Across Blocks
(Percent)

Sources: ERC and IMF staff calculations.

19.   Network losses are high by international standards as a result of both technical and commercial losses in the distribution system.

While North Macedonia has managed to lower distribution losses, over the last decade, they have plateaued in recent years, and with distribution losses reaching 13.5 percent in 2022, North Macedonia ranks highest among European countries (Figure 11A) except for Kosovo (28% in 2018) and likely Albania (24% in 2014). Anecdotal evidence suggests that 2/3 or this is technical losses in the distribution network and about 1/3 is commercial losses. Technical losses can be due to complexities with the level of voltage used in the

Electrical Distribution Losses, Latest Year Available
(Percent)

Average = 6.6 percent

Sources: CEER; ERC; and IMF staff calculations.

distribution system and it can be due to underinvestment in the network. Commercial losses are due to mismeasurement or illegal tapping of the network. From a climate perspective, technical losses, i.e., where there is electricity produced without an end-use of this electricity, leads to unnecessary emissions.
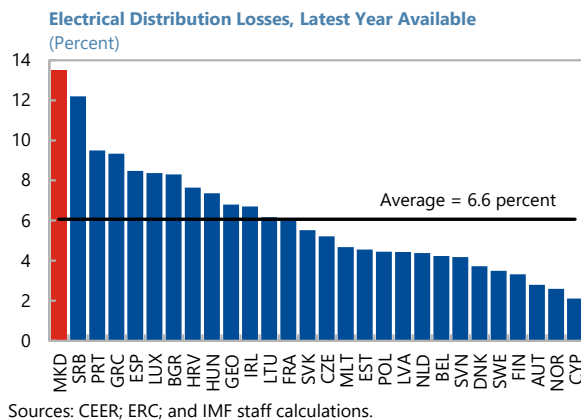
20. **The government adopted new measures to lower subsidies, distribution losses, and strengthen price signals in the regulated electricity market.** The government adopted in December a decision to increase the price charged by the ESM to the universal supplier from 53 €/MWh to 57 €/MWh, as well as the price charged by the ESM for covering distribution losses from 100 €/MWh to 105 €/MWh. More importantly, the government decided that from January 1st, 2024, the ESM is only mandated to provide 95 percent of the demand of the regulated market, instead of 100 percent, and 85 percent from 1st July 2024. This will help lower electricity subsidies from the government and introduce a still modest element of market pricing into the regulated market.

21. **Further measures are needed to phase out electricity subsidies and for energy subsidies to no longer remain a key vulnerability to public finances.** There is a need to continue bringing electricity prices in line with the cost recovery price of the ESM, as long as the ESM is required to supply a certain amount of electricity for the regulated market. This would mean continuing gradually raising tariffs, including non-peak tariffs, toward the cost-recovery level. In addition, further progress should be made towards an effective price signal mechanism in the regulated market, and further steps towards gradually decreasing the share of the demand in the regulated market mandated to be covered by the ESM, thereby further exposing the ESM to competition, and allowing for a stronger, although still gradual price signal mechanism. Finally, the very large share of households that receive heavily subsidized electricity in blocks 1 and 2 should be reduced, either with tariff adjustments, and/or through calibrating the eligibility thresholds for the block-tariffs. To protect vulnerable households in the process, a life-line tariff could be considered, as well as expanding and targeting the existing program for vulnerable households (see Box 2).

Box 2. Key Recommendations of IMF Technical Assistance on Electricity Subsidy Reform

The IMF provided technical assistance to the authorities in January 2023 on electricity subsidy reform. The objective was to provide key recommendations, to assist the authorities Energy Action Plan to gradually phase-out subsidies, while protecting vulnerable households. The report made the following key recommendations:

- **ESM pricing should be set to phase out subsidies in a resumption of the transition to market liberalization.** Return to the intent of the 2019 market liberalization reforms gradually reducing the ESM's obligation to supply the regulated market with subsidized electricity, and reduce the price distortions currently in the system, supporting efficient use of electricity.

- **The structural issues in the generation sector must be addressed with a coherent approach that prioritizes feasibility and timeliness alongside capacity gains.** Without sustained and notable levels of investment in generation and the grid, the import dependence of the electricity sector will only grow, raising system vulnerability and the risk of continued need for fiscal support. Prioritization of generation projects could drastically increase the speed of their implementation. Feasibility and timeliness should be important criteria alongside capacity gains, with a focus on renewable sources.

- **An incentive-based regulation of the distribution operator could help improve efficiency and, ultimately, electricity service quality, which is currently lagging behind European peers.** Distribution losses have been stabilizing at an abnormally high level in the past four years, weighing on the quality and continuity of electricity service provided to final consumers. Given the weight of distribution charges in the average end-user tariff, it is important that these charges reflect efficient distribution operations to avoid the building of producer subsidies at the expense of consumer welfare.

> **Box 2. Key Recommendations of IMF Technical Assistance on Electricity Subsidy Reform (Concluded)**
>
> • **As sole supplier of the regulated end-user market with a contractual margin, the universal supplier is in a dominant position that should be carefully monitored for fear of reduced consumers' welfare.** Reduce the margin rate of the universal supplier and exclude from the margin base elements that cannot be controlled by the universal supplier.
>
> • **The regulated tariff-setting process should be streamlined and made more transparent, as it currently involves several stakeholders with possibly non-converging objectives.** The number of institutions involved in the tariff-setting process should be streamlined and the process itself be made more transparent, through regular public accounts by ERC (e.g., on the media, to Parliament) and a detailed breakdown of tariff components on consumers' bills.
>
> • **Prices should be allowed to reflect costs while targeted transfers or bill discounts not linked to electricity consumption should be delivered to vulnerable households complemented with policies to increase energy efficiency.** Financial assistance for bill payment is currently decoupled from consumption, although not adequate to protect the vulnerable from price increases. These financial measures should be complemented by policies to increase the energy efficiency (e.g., financial support for building retrofitting and buying efficient appliances), especially of poorer households, to reduce consumption and make households more resilient to future price shocks.
>
> • **The design and implementation of programs to mitigate the financial impact of price increases on the vulnerable should be streamlined and revised.** The creation of the PPVEC to address energy vulnerability suggests that there is limited overlap between beneficiaries of the GMA and social pension and those deemed in need of assistance with their electricity bill. Phasing out this type of assistance through the GMA and the social pension, not designed to address energy poverty, and revamping the PPVEC could improve the targeting and adequacy of compensation. While these benefit updates are undertaken, the government could rely on changes to the tariff structure, such as creation of a lifeline block, to avoid extreme welfare losses to vulnerable households initially excluded from social benefits.
>
> **Data quality is fundamental for the assessment of the distributional consequences of the electricity subsidy and potential compensatory measures.** These data could come from administrative sources, such as a unified social registry that is integrated with the database of customers of the universal electricity provider that are eligible for social benefits. A revision of the HBS is needed so it collects better data on electricity consumption and social benefits.

E.   The Role of Public Investments[8]

22.   Public investments and policies play a key role in reducing carbon emissions and adapting to climate change. Climate change is causing natural disasters to become more frequent and with a higher economic and social impact. A significant number of resources will be needed to ensure that countries can maintain and build infrastructure that is resilient to climate change.[9] In North Macedonia, the authorities estimate that the cumulative capital investment needs (public and private) are between €18.5 billion and €34.1 billion through 2050 (30 years), depending on the level

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[8] This section draws on an unpublished IMF Technical Assistance report on C-PIMA, prepared by I. Rial, K. Funke, A. Navarro (all FAD), and K. Cleary (FAD expert).

[9] A World Bank analysis found that natural disasters cost about US$18 billion a year in low- and middle-income countries through damages on infrastructure assets, which have to be rebuilt. (World Bank, 2019, Lifelines: The Resilient Infrastructure Opportunity. World Bank, Washington D.C.)

of ambition in reducing GHG emissions and strengthen climate resilience. This is equivalent to 4.3–8.0 percent of 2023 GDP annually, and 130–241 percent of GDP cumulative.

23.   North Macedonia launched an energy transition investment platform in December 2023. The platform is supported by the EBRD and is intended to bring together the government, IFIs, and the private sector on investment and policy development for the country's energy transition. With a target under the platform of completely phasing out coal-fired power plants and deploying 1.7 GWs of renewable energy by 2030, as well as grid storage and investments for energy security. Achieving this objective will require estimated investments of €3 billion (20 percent of 2023 GDP) by 2030. To cover such large investment needs, would require a strong PIM framework, that also incorporates climate considerations. Similarly, a sound PIM framework is essential to attract private capital that can complement the government's efforts.

24.   Public Investment Management, including from a climate-change sensitive perspective, is in its early stages in North Macedonia. Awareness of the importance of addressing climate change and the role of public investment in infrastructure in this objective has increased, but there are no tangible results yet in this area. This is partly driven by the overall weakness of public investment management in the country, as highlighted in the 2020 PIMA report. To address these deficiencies, the government adopted a PIM action plan in 2021 that should guide reforms to enhance planning and appraisal of projects, as well as budgeting to ensure funding availability, and better monitoring during implementation. This ongoing PIM reform process offers an opportunity to incorporate climate-change sensitivity into the new framework. The authorities undertook a Climate Module of the PIMA that would identify key reforms that could be introduced along the more general PIM reform process (see Box 3 and 4).

Box 3. The Climate PIMA Framework

The Climate module of the Public Investment Management Assessment (PIMA) of the IMF aims to identify the main institutions—processes and practices—that are critical for developing climate-smart infrastructure. The assessment focuses on five priority areas—institutions—for the integration of climate considerations in the public investment management cycle. These areas are:

- **Planning:** national and sectoral plans, and associated investment portfolios should be aligned with climate objectives for transforming public sector infrastructure in the direction of climate-resilience and sustainability.

- **Coordination:** ensure that all stake holders within the different levels of government and on joint-ventures with private sector are coordinated in their areas of involvement.

- **Appraisal and selection:** include climate-related analysis of mitigation and adaptation impacts of investments in the decision-making process on major infrastructure projects.

- **Budget and portfolio management:** appropriate budgeting and reporting practices of green investments and maintenance are followed, and asset management includes climate-related impacts.

- **Fiscal risk management:** governments should have the capacity to understand the impacts of climate change on public infrastructure and mechanisms to address its impact.

25.   The Climate Module of the PIMA identified good emerging practices and priority areas for reform, particularly in budgeting and project appraisal and selection. Some existing regulation is already taking steps to improve mitigation, such as building codes requiring energy efficiency, which are in line with the EU regulations. Coordination with PCs on their climate-related investments, particularly in the energy sector which is a key player in this respect in North Macedonia, is done during the annual dialogue on NDC commitments. The Organic Budget Law provides for budget reserves against the impacts of natural disasters, including on infrastructure. However, project appraisal in general is weak and climate impact considerations are not being taken in consideration during design or project selection. Moreover, there is no information on climate-related spending in the budget or a reliable register of assets, which undermines the government's capacity to manage the impacts of climate-related risks on public infrastructure.

Box 4. Priority Areas for Reform outlined by the Climate-PIMA

- **Ensure that the Enhanced Nationally Determined Contributions (ENDC) infrastructure-related objectives, targets, and expected outcomes are fully integrated into national and sectoral development strategies for infrastructure.** Except for the energy sector, international climate change related commitments, including for climate mitigation and adaptation are not consistently mainstreamed into national and sectoral plans. The authorities should introduce a climate change perspective to the spatial planning process, ensuring that climate change related targets for infrastructure are properly aligned, and review construction codes from both climate mitigation and adaptation perspectives. They should also develop guidance and provide training to public bodies on how to integrate climate change considerations in public investment planning.

- **Use existing coordination and reporting channels to improve public investment decision-making process across the public sector, including climate change considerations.** Coordination across the public sector of planning decisions on climate-related public investment could be improved. The authorities should develop a reporting format for all budgetary units, local governments, and public companies to report to MoF 's PIM Department on capital projects. They should also require public companies to produce annual sustainability reports as part of the monitoring framework.

- **Incorporate analysis of the impacts of climate change in planned methodologies for project appraisal and project selection.** Climate change impacts are currently not accounted for in project appraisal and project selection. The authorities should incorporate analysis of the climate change impacts in the forthcoming central methodology on project appraisal, including at a minimum: Analysis of the likely impacts of the project on GHG emissions and other climate change mitigation measures; and analysis of the likely exposure of the project to climate-related harm from extreme weather and natural disasters and the construction, operation and maintenance cost implications arising. The authorities should review and update the standard criteria for project prioritization and include climate change issues as criteria. Ensure the criteria directly inform project selection.

- **Incorporate analysis of the impacts of climate change in the planned PPP framework.** The PPP framework does not adequality account for the impact of climate change. The authorities should develop procedures for accounting for the climate-related risks in PPP preparation and management, specifically: Pre-assess climate change-related risks to the project; Determine strategies for adaptation and asset resilience; Assess and determine the appropriate allocation of risk between the government and private partner.

- **Leverage existing budget tools informing annual investment allocation decisions to strengthen the PIM function, including from a climate change perspective.** Climate change considerations could be better integrated in the budgetary process. The authorities should incorporate

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Box 4. Priority Areas for Reform outlined by the Climate-PIMA (Concluded)

within the Budget Circular a requirement for all proposals that request increased capital allocations, above a threshold, to describe the expected impacts of this investment on GHG emissions and climate resilience and reflect this requirement in the Budget Circular guidelines.

- **Gradually implement green budgeting reforms supporting PIM.** For similar reasons as above, the authorities Establish a working group to consider, formalize and publish a definition of spending that may be beneficial to climate outcomes. This should be followed by requiring line ministries to apply this definition to areas of expenditure within their remit. For full overview, consider publishing a table of all expenditures identified under the above as part of the final annual budget publication.

- **Screen critical infrastructure for climate resilience.** Risk management procedures for investment and asset maintenance needs to be further developed and do not account for climate risks. The authorities should consider developing a national database of critical infrastructure and expand the screening exercise to determine the potential vulnerability of this infrastructure to identified climate risks.

- **Include the analysis of climate change related fiscal risks and their impact on public infrastructure within the ongoing efforts to strengthen overall fiscal risk management.** There is limited analysis or information on climate-related fiscal risks in general, and on its impact on public infrastructure, published alongside budget documents. The authorities should disclose a qualitative assessment of climate change related risks on public infrastructure either in a fiscal risk statement or as part of the information accompanying budget documents. They should also consider developing climate assessment models that allow to estimate the impact of climate change scenarios on fiscal sustainability.

- **Redouble efforts to increase the number and expertise of PIM staff across the government.** There is an urgent need to increase capacity for PIM and climate-aware PIM in the Ministry of Finance and wider government sector. The authorities should prioritize hiring to fill vacancies in the PIM Dept. as a matter of urgency. They should consider designing and implementing a talent retention scheme for the PIM Dept. Also, PIM Dept. staff should be provided with advanced training on project appraisal and selection methodologies incorporating climate considerations., as well as provide training more broadly to public sector PIM staff on project appraisal and selection incorporating climate considerations.

Develop a basic short-term IT solution to bridge critical information gaps undermining public investment management, including climate-related impacts on infrastructure. Information on public investments is limited due to a fragmented framework. If appropriately designed, the new IFMIS system, developed in collaboration with the World Bank, could help address some of these concerns, yet its completion will require several years, undermining the uptake of climate-related PIM. In the near-term, the authorities should develop and populate a template that captures key information, including climate-related, on public investment projects from planning through implementation.

F. Simulations of Carbon Pricing and Preparing for the EU Carbon Border Adjustment Mechanism

26.   The EU Carbon Border Adjustment Mechanism (CBAM) is designed to prevent carbon leakage and create a level playing field.[10] The EU has been at the forefront of using a carbon emissions trading system (ETS) to encourage industrial de-carbonization. As a result of rising taxation of carbon emissions, there is a risk of carbon leakage where EU companies move emission-intensive production abroad. The CBAM is designed to prevent carbon leakage and create a level

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[10] Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism.

playing field. From 2026 EU importers of goods originating from outside the EU are required to purchase certificates equivalent to the weekly EU carbon price if the imported goods are not subject to equivalent carbon pricing as the EU ETS.[11] The CBAM initially applies to imports in selected emission-intensive sectors: Cement, Iron and Steel, Aluminum, Fertilizers, Hydrogen, and Electricity. The CBAM will be phased-in during 2026–2034 as the free allowances under the EU ETS are phased-out. From 2035, the CBAM will include all products covered under the EU ETS,[12] with the possibility of the product scope being reviewed, such that other products may be included from 2030 already.

27.   The EU CBAM will introduce a higher cost for importers of some of the main export categories of North Macedonia. As the CBAM is gradually phased-in with the phasing-out of the free allowances under the ETS, the impact will not be immediate in 2026, but gradual during 2026–2034, although with a potential bigger impact earlier if the scope is broadened. Exports to the EU are just under 20 percent of North Macedonia's GDP, but most of total exports. Around 20 percent of goods exported to the EU are covered by the CBAM and will be subject to the EU CBAM taxation. Since EU is the key trading partner for North Macedonia, it is unlikely that exports can be re-directed, as well as a negative impact on third-country exports may have a limited economic impact.

28.   Staff simulate the impact of phasing in a carbon tax consistent with the EU CBAM. Staff use the IMF-WB CPAT model, c.f. Box 5, to simulate the impact of a carbon tax on North Macedonia. The model is parameterized to gradually introduce a 50 USD per ton CO_2 tax starting in 2024 and linearly increasing until 2035. The baseline results assume that revenue from the carbon tax is recycled as corporate taxes (15 percent), public investment (40 percent), current spending (30 percent) and cash transfers (15 percent), where the distribution follows IMF Working Paper (2023). The results of this simulation are discussed below.

   a. *Welfare.* The simulated policy increases welfare gradually as the policy is enacted. Welfare benefits stem from lower GHG emissions and air pollution co-benefits, such as lower mortality and morbidity. The cost of the policy is from a loss in efficiency due to higher taxation. The welfare benefits average around 1.0 percent of GDP, per annum, in the medium run.

   b. *GDP.* The simulated policy lowers GDP growth marginally in the intermediate period as firms and households respond to higher carbon prices. While not considered directly, the carbon tax may also fuel inflationary pressures by increasing energy prices. However, this is expected to be relatively minor as the simulated policy occurs over a long horizon.

   c. *Pollution.* The simulated policy directly lowers GHG emissions by around 3 metric tons of CO_2 equivalents. This results in climate benefits to the population. Additionally, improved air

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[11] The EU CBAM will be in a pilot phase in 2023–2025 with only reporting requirements but is planned to be fully operational (implemented) from 2026.
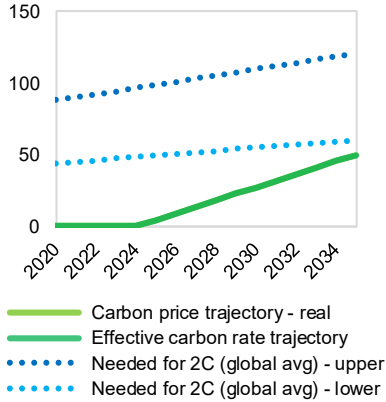
[12] In addition to those selected to be covered under the CBAM, the EU ETS covers a broader range of products such as metals, lime, glass, ceramics, pulp, paper, cardboard, acids, and bulk organic chemicals.

quality results in co-benefits, such as lower instances of pollution-related mortality and morbidity.

Figure 6. Simulated Impact of Carbon Pricing Consistent with EU CBAM

The simulated policy gradually increases the carbon tax to 50 USD per carbon ton...

Policy Strength: Carbon Price Trajectory (US$ per tCO2e, 2020-2035), North Macedonia

Carbon price trajectory - real
Effective carbon rate trajectory
Needed for 2C (global avg) - upper
Needed for 2C (global avg) - lower

Effective carbon rate adjusts for coverage.

...despite a moderate decline in GDP growth due to the higher burden from the carbon tax...

GDP: Annual Growth Forecasts (Baseline and Policy Scenario)
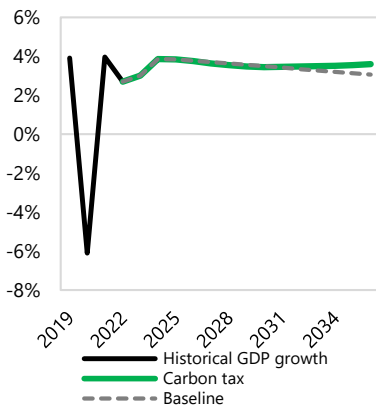
Historical GDP growth
Carbon tax
Baseline

Shows projected GDP growth rates under baseline and policy scenario (including any revenue-recycling). Approach uses fiscal multipliers to estimate impact of each year of the policy on subsequent years.

...increasing welfare by around 1 percent of GDP per year when the policy becomes fully realized...

Total Monetized Welfare Benefits for US$50 Carbon Tax p/t CO2e by 2035, North Macedonia

Efficiency costs
Transport co-benefits
Air pollution co-benefits
Climate benefits
Net
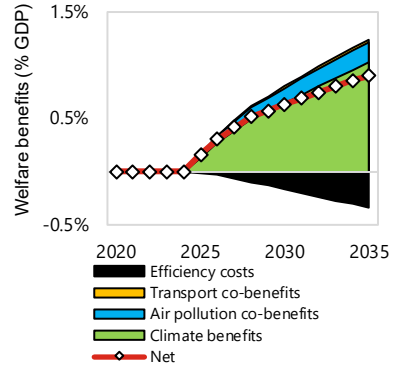
Shows monetized net welfare benefits. Efficiency costs are deadweight losses in fuel markets from changes in fuel prices, not accounting for revenue recycling benefits or tax interaction effects.

...because of a large decline in GHG emissions.

GHG Emissions vs. Paris Pledge ('NDC'; mtCO2e exc LULUCF), North Macedonia

Baseline
- Carbon tax
Nationally-Determined Contribution (NDC)
Net Zero Emissions Pathway
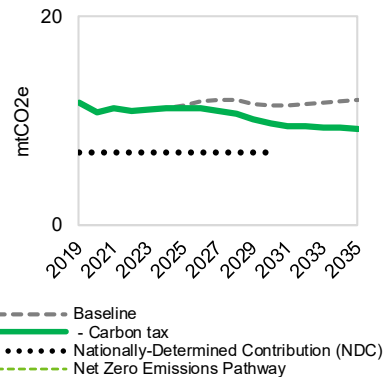
Latest NDC target for North Macedonia is a 51% reduction in absolute emissions by 2030 vs. 1990. Policy achieves 15% vs. BAU in 2030, which is 38.1% of the emissions reductions vs. BAU for NDC.

29.   The welfare benefits of the simulated policy are sensitive to the extent and fiscal impulse of revenue recycling. The right figure reports the simulated policy when revenue collected from the carbon tax is not recycled, providing an upper bound on the efficiency cost of a carbon tax. The simulation shows that growth falls by around 50-60 basis points over a transition period as the carbon tax is introduced and does not return to the business-as-usual baseline until after the carbon tax becomes fully implemented. Policy design should then be careful that revenues collected from carbon taxes are used productively to offset costs.
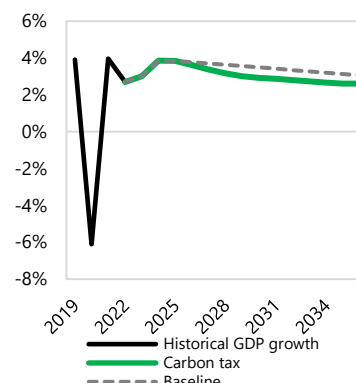
30.   Not introducing an equivalent carbon tax will result in foregone fiscal revenues in North Macedonia, which may instead be collected by the EU. The revenue from the EU CBAM system will be collected by the EU. If North Macedonia instead adopts an equivalent tax measure, such as a form of CO_2 tax, the tax revenue would instead be collected as revenue in the state budget of North Macedonia, which provides for some selective recycling opportunities which could mitigate the economic and distributional effects of a carbon tax as well as further support the green transition.

GDP: Annual Growth Forecasts (Baseline and Policy Scenario)

Shows projected GDP growth rates under baseline and policy scenario (including any revenue-recycling). Approach uses fiscal multipliers to estimate impact of each year of the policy on subsequent years.

Box 5. Climate Policy Assessment Tool (CPAT)

The Climate Policy Assessment Tool (CPAT) is a spreadsheet-based model developed by the IMF and World Bank to help economist analyze the impacts of different climate policies, covering over 200 countries. The toolkit is a "model of models" that integrates several modules analyzing the effect of climate change and mitigation policies on different parts of the economy. This allows policymakers to examine the tradeoffs of policies on several parts of the economy. The results are divided between the areas:

- *Energy and emissions.* Examine the effects on prices, consumption, global pollutants (GHGs), local pollutants (PM2.5, NOx, etc.).

- *Macroeconomic impacts.* Effect on GDP, government revenues, trade balance.

- *Distributional impacts.* Effects of policies and revenue recycling on households (across income distribution and urban versus rural) and firms.

- *Development co-benefits.* Reductions in mortality and morbidity from improved air quality, road safety, and reduced congestion.

A benefit of the CPAT model is that it allows for the benefits of revenue recycling from policies to be integrated into the analysis. For example, a benefit of increasing carbon taxation is that it can free fiscal space to lower labor or corporate taxes. These indirect benefits counter the direct costs of policies on the economy providing a more accurate assessment of climate policy.

The baseline for the CPAT analysis is the business-as-usual (BAU) scenario. The BAU scenario assumes that growth follows the IMF WEO projections and pollution and policy follow its current path.

Box 5. Climate Policy Assessment Tool (CPAT) (Concluded)

Underlying the CPAT model is the energy demand for a given set of policies. The sector-specific demand for energy sources can be written as the usage of energy-consuming products in that sector multiplied by the energy consumption rate. Usage depends on the size of the economy (GDP) and the intensity of energy use (prices) while the energy consumption rate depends on energy efficiency (technology) and price-induced energy efficiency (prices). Together, this implies that energy demand can be written as a function of the previous year's energy demand, the growth effect from higher economic output, the exogenous technology change effect, and the price effect from changing energy prices. This can be written as:

$$E_t = E_{t-1}^{E_i} * \left(\frac{GDP_t}{GDP_{t-1}}\right)^{\nu_t} * \left(\frac{1}{1+\alpha}\right)^{1+\eta^u} * \left(\frac{p_t}{p_{t-1}}\right)^{\eta^h+\eta^u+\eta^h\eta^u},$$

where α is a (exogenous) technology improvement rate and ν_t, η^u, and η^h are estimated elasticities that are used as inputs into CPAT.

GDP and prices are projected endogenously to the policy actions and revenue recycling considered in the policy experiment using an elasticity model. For example, this allows GDP to respond negatively to an increase in carbon prices and positively to recycle revenues used to lower labor taxes.

G. Conclusion and Key Policy Recommendations

31.   A scale-up of private and public investments, along with decommission of old and polluting coal-based power plants, is needed to adapt to climate change and meet emissions targets as part of the green transition. North Macedonia is exposed to climate change and natural hazards that pose substantial risks to public safety and public infrastructure, mainly from flooding and forest fires. North Macedonia has committed to an ambitious climate change mitigation and adaption agenda, reducing GHG emissions by more than 50 percent by 2030 compared to 1990. At the same time, there is a large potential for better energy efficiency, as well a large share of electricity is produced from fossil-fuel based energy generating infrastructure. North Macedonia recently targeted completely phasing-out coal-fired power plants by 2030.

32.   North Macedonia will be impacted by the EU-Carbon Border Adjustment Mechanism (EU-CBAM) from 2026, and the authorities should consider a gradual introduction of carbon taxation to prepare for the EU-CBAM, as also envisioned in existing legislation. The introduction of the EU CBAM will impact North Macedonia's exports to the EU negatively, as well as revenue collected as part of the EU CBAM will be foregone revenue for North Macedonia. Instead, North Macedonia should consider a form of carbon taxation, as also envisioned in existing legislation, to collect the revenue by the state, as well as recycle part of this to mitigate the impact of the carbon tax and further support the green transition.

33.   Key policy recommendations:

    a. Scale-up public and private investments to support adaptation to climate change and the phase-out coal-powered electricity production, replacing it with renewable energy sources.

b. Strengthen the public investment management framework, supported by Fund-provided TA, and introduce climate considerations in the framework.

c. Continue to phase-out electricity subsidies and develop the electricity tariff structure to incentivize greater energy efficiency among households and companies.

d. Consider a form of carbon tax to mitigate the effect of the EU CBAM and to support the green transition.

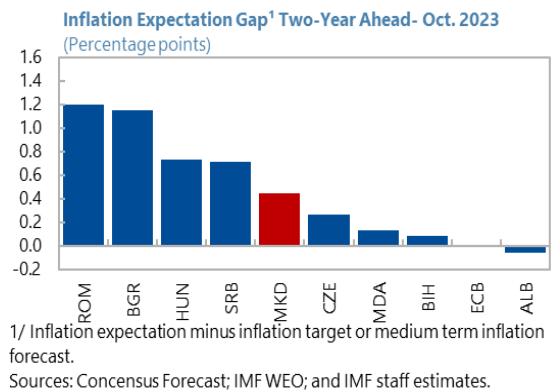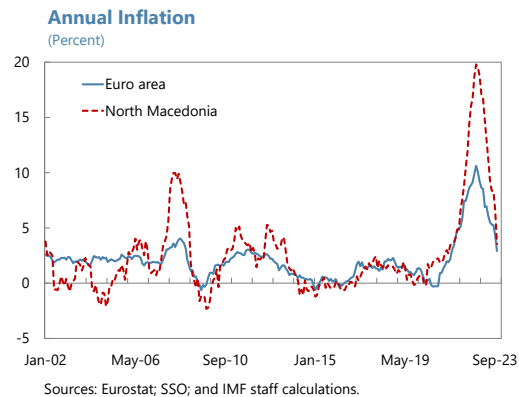# INTEREST RATE PASS-THROUGH IN NORTH MACEDONIA[1]

This paper highlights that the monetary framework has been effective in achieving price and exchange rate stability and to keep inflation expectations well anchored. However, the interest pass-through of the monetary policy rate to domestic market interest rates in North Macedonia is modest compared to other regional peers. While part of the modest pass-through is attributed to structural features (such as structurally high liquidity in the banking system and shallow interbank markets), improving the monetary policy operations framework would help strengthen the pass-through.

A. Introduction

1.   North Macedonia follows a pegged exchange rate strategy, but rigidities in capital flows allow the central bank to implement independent monetary policy. The National Bank of North Macedonia's (NBRNM) primary objective is price stability, which is achieved by targeting the nominal exchange rate of the Denar against the Euro. The "de facto" peg has served as an anchor for almost three decades. However, due to rigidities in capital flows—high risk premiums and a shallow securities market—the NBRNM has room to influence domestic interest rates via the Central Bank bills rate (policy rate).

2.   The monetary framework has served the central bank well to achieve its mandate. North Macedonia's inflation has been close to that of the Euro area inflation for the last three decades, barring some short-lived deviations. Nevertheless, the surge in energy and food prices caused by Russia's invasion of Ukraine represent a new test for the framework.

Annual Inflation
(Percent)

Sources: Eurostat; SSO; and IMF staff calculations.

3.   The expectations channel has a key role in monetary policy, and inflation expectations remain well anchored. Despite the sizable shocks on global inflation in 2022–23, inflation expectations (two-year ahead) remain close to the medium-term inflation (2 percent). The country's inflation expectation gap—a usual measure of expectations anchoring—is at less than ½ percentage point and is significantly smaller than that of some peers. The fact that the gap is relatively small is remarkable considering the sizable shocks the economy faced, and suggests a robust anchoring of inflation expectations.

Inflation Expectation Gap[1] Two-Year Ahead- Oct. 2023
(Percentage points)

1/ Inflation expectation minus inflation target or medium term inflation forecast.
Sources: Concensus Forecast; IMF WEO; and IMF staff estimates.

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[1] This paper was prepared by E. Cabezon and S. Kovachevska Stefanova.

4.   At the same time, the monetary framework has allowed the country to maintain adequate levels of international reserves. The framework has yielded confidence and stability, which has facilitated international trade and FDI inflows. In this context, the NBRNM has accumulated international reserves. While reserves have fluctuated to stabilize external accounts, they have been on an upward trend as a share of GDP. They compare well with reserve levels of peers, and today provide considerable buffers to face external shocks. In turn, the stability of the exchange rate and low inflation has facilitated the financial deepening.

International Reserves
(Percent of GDP)

1/ Includes Albania, Armenia, Bosnia and Herzegovina, Bulgaria, Czech Rep., Georgia, Hungary, Moldova, Poland, Romania, and Serbia.
Sources: IMF WEO; and IMF staff estimates.
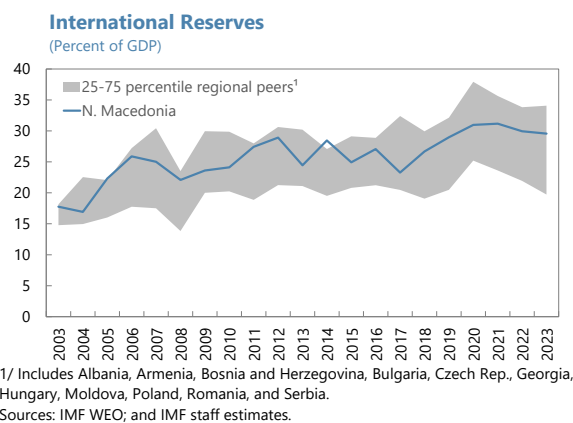
5.   An effective interest rate channel is also an important element for effective monetary policy. By changing the monetary policy rate, NBRNM aims to tighten financial conditions affecting consumption and investment decisions, and eventually stabilizing prices. The interest rate pass-through—that measures the response of market interest rates to the monetary policy rate—has a crucial role in the transmission of monetary policy, and it is even more relevant in the current context of inflationary pressures.

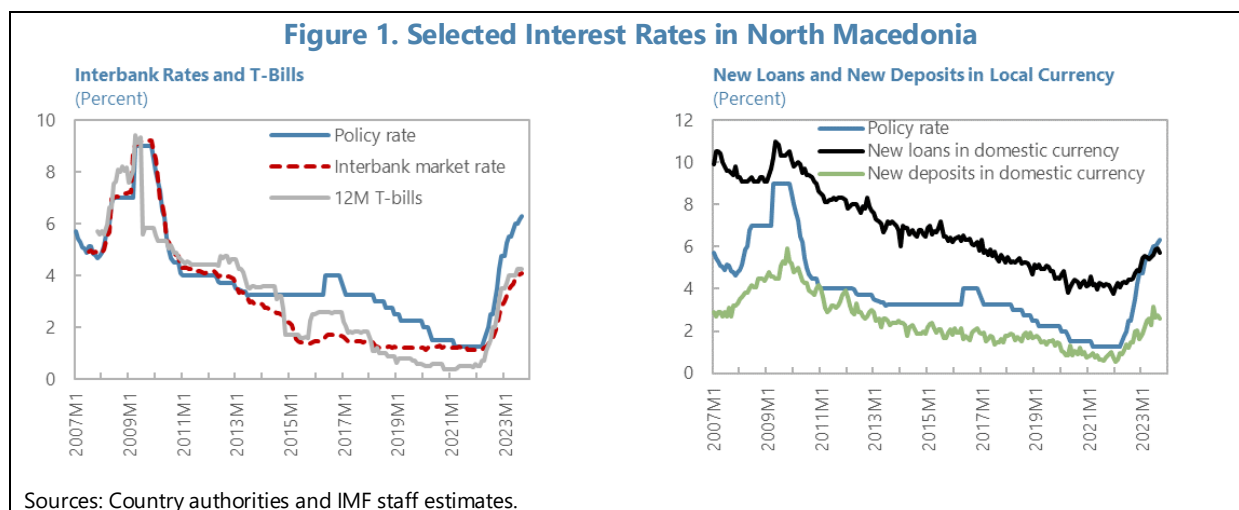**6.   When judging the interest rate transmission in a country like North Macedonia, several important caveats need to be kept in mind.** The standard transmission of interest rates— via the interbank market—is hampered as banks keep significant excess reserves. This structurally high liquidity is in part due to the significant share of remittances in the economy. In turn, banks have limited incentives to borrow from NBRNM or the interbank market, which is shallow. Separately, high euroization reduces the base of deposits and loans affected by the policy rate. Still, the NBRNM's policy rate plays a key role to influence retail interest rates, as a signaling device, which is why it is important to assess the pass-through of the monetary policy rate to domestic interest rates.

Figure 1. Selected Interest Rates in North Macedonia

Interbank Rates and T-Bills
(Percent)

New Loans and New Deposits in Local Currency
(Percent)

Sources: Country authorities and IMF staff estimates.

B. What is the Interest Rate Pass-Through to Domestic Market Rates?

7.   This section assesses the pass-through of the monetary policy rate to domestic market interest rates. To examine the pass-through to interbank rates, T-bills yields, and retail (deposit and lending) interest rates, this section (1) calculates the implicit pass-through during the current monetary policy tightening cycle, (2) assesses the transmission within a month using simple regressions; and (3) uses the framework developed by Mishra, Montiel, and Spilimbergo (2012) to account for pass-through delays. To gain deeper understanding of the pass-through, the results are benchmarked against regional peers.[2]

8.   The empirical literature about the interest rate pass-through in North Macedonia is limited. While literature on pass-through is extensive (See J. Gregor, Melecky and Melecky (2021)), the literature for North Macedonia is narrow. Bogoev and Petreski (2012), Saiti and others. (2021), Hadzi-Velkova (2023) found that the interest rate pass-through from the NBRNM's policy rate to selected retail banking rates is less than full. Other studies such as Velichkovski and Mamuchevska (2019), Petreski and Bogoev (2012) compared the interest rate pass-through with other regional peers and confirmed that the interest rate channel of transmission is limited for North Macedonia. Nevertheless, Eliskovski (2018), looking at monetary signals (not just interest rates) in an error correction model, documents that tightening signals contain banks' lending and the that easing signals encourage lending if they are supported by favorable balance sheets and favorable macroeconomic conditions.

9.   During the current monetary policy tightening cycle, the implicit elasticities of domestic interest rates to the NBRNM's policy rate have been lower than in regional or advanced country comparators. The elasticity of interest rates to policy rate shows that, compared with regional peers, there is low pass-through to interbank rates and banks' retail (loans and deposits) rates in North Macedonia.[3] In contrast there is strong pass-through to T-bills (See text chart and Table 1).

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[2] Monthly data for Jan-2007 to Sep-2023 and regional peers include Albania, Czech Republic, Hungary, Poland, Romania, and Serbia.

[3] Average rates for new loans and deposits in local currency.

Figure 2. Selected Implicit Elasticities
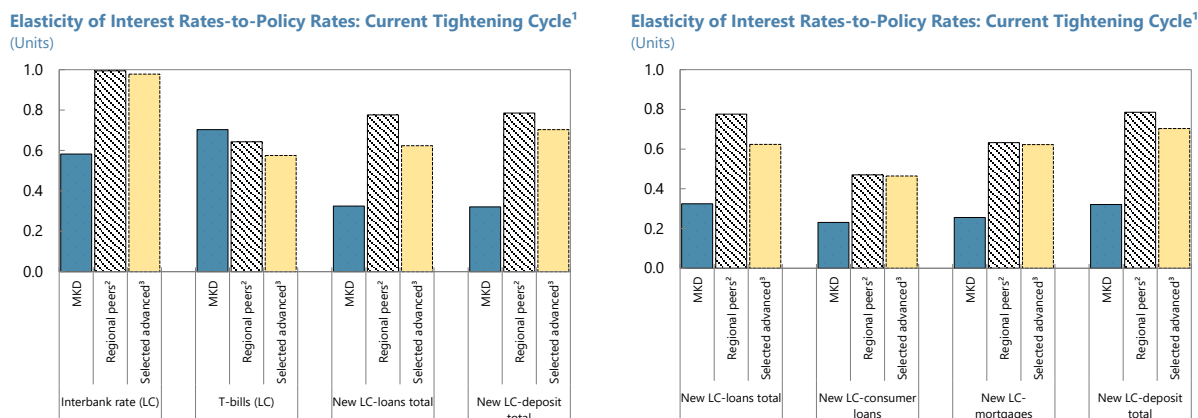
Elasticity of Interest Rates-to-Policy Rates: Current Tightening Cycle[1]
(Units)

Elasticity of Interest Rates-to-Policy Rates: Current Tightening Cycle[1]
(Units)

Note: Elasticity = $\frac{\Delta \text{ Interest rate x}}{\Delta \text{ policy rate}}$ LC = Local currency.

1/ Current tightening cycle starts as a country starts increasing policy rate (e.g., Oct. 2021) and ends when the country start reducing the policy rate or in the latest available data (Sep. 2023) if the country has not started to reduce the rate.

2/ Regional peers (median) includes Albania, Serbia, Czech Rep., Hungary, Poland, and Romania.

3/ Selected advanced (median) includes Euro Area, Sweden, Switzerland, and United Kingdom.

Sources: IMF staff estimates.

Table 1. North Macedonia: Event Study—Current Tightening Cycle[1]

	North Macedonia	Albania	Serbia	Hungary	Poland	Romania	Czech Rep	Euro area	U.K.	Sweden	Switzerland	Regional Peers[2]	Selected Advanced peers[3]
First month of tightening	Apr-2022	Mar-2022	Apr-2022	Jun-2021	Oct-2021	Oct-2021	Jun-2021	Jul-2022	Dec-2021	May-2022	Jun-2022	Jun-2021	Jun-2022
Acumulated Δpolicy rate (percentage points)	5.05	2.50	5.50	12.40	6.65	5.75	6.75	4.50	5.15	4.00	2.50	6.20	4.25
Months of tightening up to Sep-2023	18	19	18	28	23	24	29	15	22	17	16	24	17
Implicit elasticity													
Interbank interest rate (local currency)	0.58	1.05	0.84	0.99	1.01	0.75	1.00	0.92	1.00	1.00	0.96	0.99	0.98
T-bills (local currency)	0.70	0.63	...	0.64	0.72	0.64	0.67	0.56	0.90	0.59	0.54	0.64	0.58
New local currency-loans	0.32	0.51	0.95	0.78	0.95	0.66	0.77	0.66	0.56	0.80	0.58	0.78	0.62
New local currency consumer loans	0.23	-0.05	0.30	0.62	0.80	0.63	0.32	0.51	0.50	0.43	0.15	0.47	0.46
New local currency mortgages	0.26	0.25	0.81	0.41	0.77	0.80	0.50	0.45	0.68	0.73	0.56	0.63	0.62
New local currency-deposit	0.32	0.40	0.71	0.84	0.77	0.80	0.90	0.31	0.93	0.74	0.66	0.79	0.70

Note: Elasticity = $\frac{\Delta \text{ Interest rate x}}{\Delta \text{ policy rate}}$ LC = Local currency.

1/ Current tightening cycle starts as a country starts increasing policy rate (e.g., Oct. 2021) and ends when the country start reducing the policy rate or in the latest available data (Sep. 2023) if the country has not started to reduce the rate.

2/ Regional peers (median) includes Albania, Serbia, Czech Rep., Hungary, Poland, and Romania.

3/ Selected advanced (median) includes Euro Area, Sweden, Switzerland, and United Kingdom.

Sources: IMF staff estimates.

10.   Similarly, the contemporaneous pass-through of policy rates to domestic interest rates estimated over a longer period has also been low. Regressions of monthly changes in domestic interest rates on changes in the NBRNM's policy rate for the period Jan-2007 – Sep-2023, point to a moderate historical pass-through. The pass-through is also low across different kinds of loans (see text figure, and Table 2 appendix). These regressions rely on the assumption that, within a month, the impact of the policy rate is the main driver of variations in domestic markets interest rates and that the impact of other variables is limited in that period.

Figure 3. Contemporanous Interest Rate Pass-Through—2007M1–2023M9

Notes: Elasticities(β) estimated regressing Δinterest rate = α + βΔpolicy rate.

LC = Local currency.

1/ Regional peers includes Albania, Serbia, Czech Rep., Hungary, Poland, and Romania.

2/ Selected advanced includes Euro Area, Sweden, Switzerland, and United Kingdom.

Sources: IMF staff estimates.
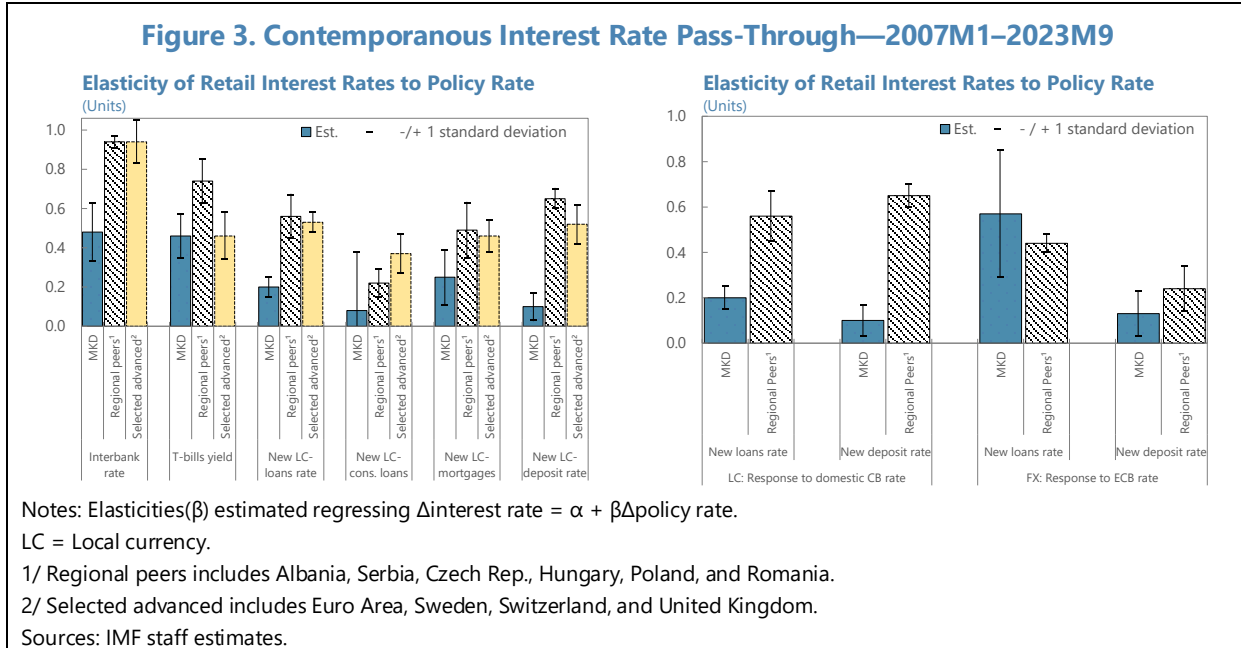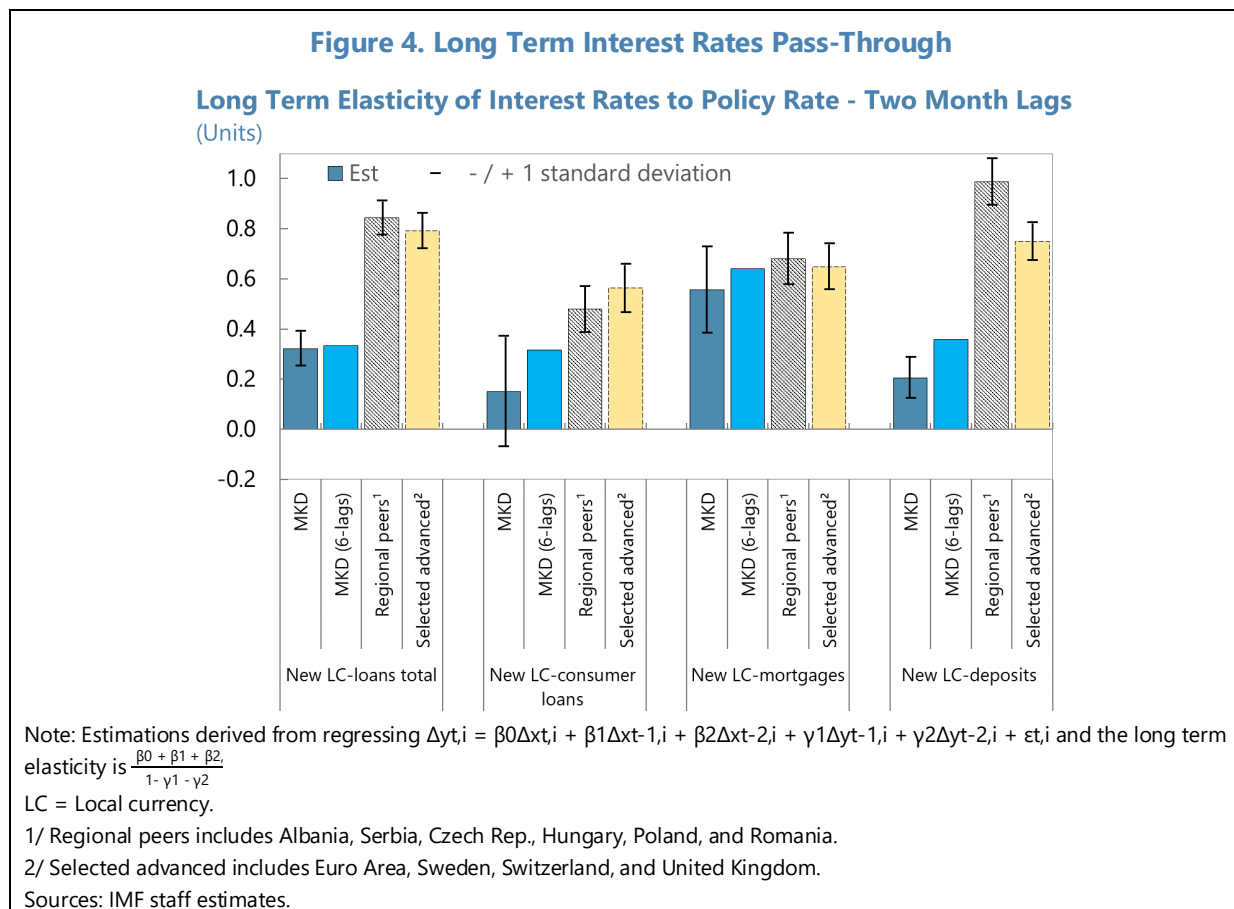
11. **Despite a moderate pass-through to denar-loan interest rates, the pass-through from ECB rates to FX-loan rates is strong in North Macedonia.** The banks' pricing of domestic and FX-loans follow different approaches. While FX-loans are priced relative to the Euribor rates, domestic loans are priced based on the banks' funding cost that differs from denar interbank interest rates due to the shallow interbank market. The fact that the elasticity of FX loan rates to the ECB rate is high in North Macedonia suggests that structural banking sector features cannot be entirely blamed for the low transmission of domestic policy rates.

12. **However, the methodology above does not account for banks' delayed response, which is important in North Macedonia and elsewhere.** Since banks have the right to revise interest rates on new loans at any moment, significant lags are observed on changes to retail rates —and sizable revisions occur every six months due to legal caps on interest rates that are updated every 6 months. Therefore, the elasticities above are re-estimated following Mishra, Montiel, and Spilimbergo (2012), which allows us to compute the long term pass-through.

13. **The estimation of the long term pass-through also suggests a moderate pass-through relative to regional peers.** The long term pass-through of the policy rate to denar-loan and deposit rates is lower than in regional peers. However, the long term elasticity of denar-mortgages is almost in line with Emerging Europe. Extending the analysis to 6-month lags to reflect that North-Macedonian banks review interest rates every 6 months, the long term elasticities are close to the peers for both consumer loans and mortgages. Nevertheless, sizable lags in the pass-through are a problem, because there is more uncertainty about the tightening or easing of financial conditions and also there are delays in the impact on real variables and eventually prices. While the methods

and estimates presented so far have limitations due to ommited factors,[4] they nevertheless provide robust evidence that pass-through of monetary policy is lower in North Macedonia.

Figure 4. Long Term Interest Rates Pass-Through

Long Term Elasticity of Interest Rates to Policy Rate - Two Month Lags
(Units)

Note: Estimations derived from regressing $\Delta y_{t,i} = \beta_0 \Delta x_{t,i} + \beta_1 \Delta x_{t-1,i} + \beta_2 \Delta x_{t-2,i} + \gamma_1 \Delta y_{t-1,i} + \gamma_2 \Delta y_{t-2,i} + \varepsilon_{t,i}$ and the long term elasticity is $\frac{\beta_0 + \beta_1 + \beta_2,}{1 - \gamma_1 - \gamma_2}$

LC = Local currency.
1/ Regional peers includes Albania, Serbia, Czech Rep., Hungary, Poland, and Romania.
2/ Selected advanced includes Euro Area, Sweden, Switzerland, and United Kingdom.
Sources: IMF staff estimates.

Box 1. Monetary Interest Rate Transmission Using Bank-Level Data

As part of the regular monitoring of its monetary policy transmission, the NBRNM has estimated the interest rates pass-through using bank-level data. This analysis looks at the impact of CB-bills rates on interbank deposit interest rates, and on the active and passive interest rates of banks. The analysis accounts for the currency, maturity, and sector structure of interest rates. Bank level data is important because banks set their Denar interest rates considering not only the key policy rate managed by the NBRNM but also their capital positions, profitability, liquidity, structure of financing, loan quality and other indicators.

The analysis uses individual micro-data by bank at monthly frequency—covering 2005M1–2022M12—and interest rates are based on the outstanding loans and deposits. A panel cointegration approach (a pooled mean group technique) is used to allow short-term coefficients to vary across different banks,

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[4] They do not account for other factors such as liquidity shocks (e.g., capital inflows, other monetary easing or tightening tools (asset purchase programs or reserve requirements), credit demand, credit risks of borrowers, and bank competition.

Box 1. Monetary Interest Rate Transmission Using Bank-Level Data (Concluded)

while long-term coefficients are the same for all banks (shown in the figures). The results suggest higher pass-through than that estimates by staff; in fact, the coefficients in this study indicate that, in the long term, there is full pass-through from policy rates to market rates,

Long Term Pass-Through to Loan Interest Rates
(Percent)

Long Term Pass-Through to Deposit Interest Rates
(Percent)
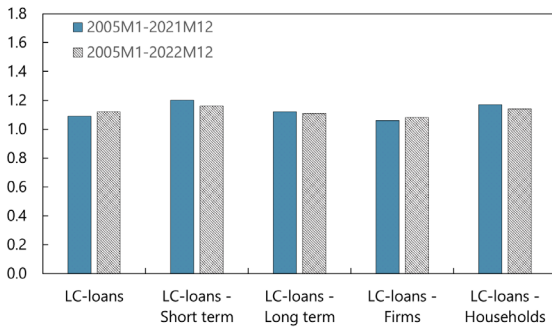
Note: Interest rates are based on interest rates of stock of loans.
Source: NBRNM.
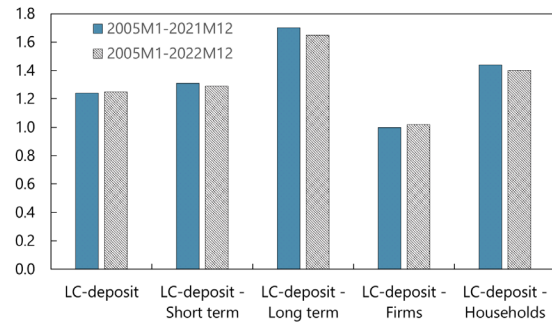
Note: Interest rates are based on interest rates of stock of deposits.
Source: NBRNM.

C.   Why is the Interest Pass-Through Moderate in North Macedonia?

14.   Moderate interest pass-through responds in part to liquidity issues:

- **Banks operate with significant excess liquidity.** As commercial banks have a strong liquidity position and little need to borrow from the NBRNM (see Figure 10.5), the policy rate is less relevant. This is illustrated by the negative slope of the scatters of pass-through and liquidity coverage ratios (LCRs).

Figure 5. Banks' Liquidity and Pass-Through to Lending and Deposit Rates

Banks' Liquidity and Pass-Through to Lending Rates
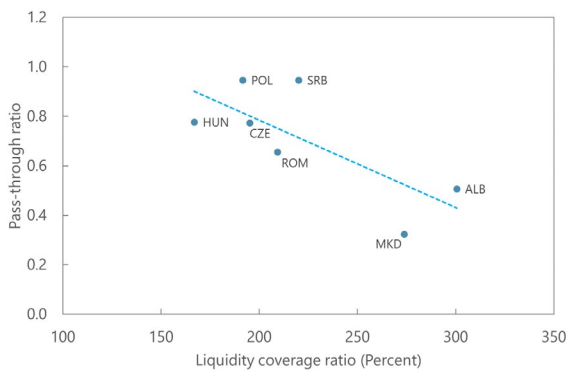
Banks' Liquidity and Pass-Through to Deposit Rates
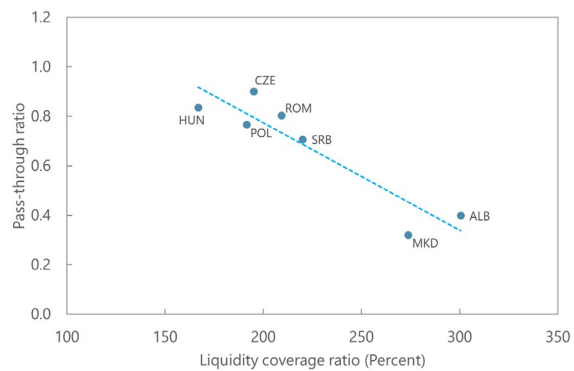
Source: IMF FSI, country authorities, and IMF staff estimates.

- **The interest corridor allows substantial flexibility for interbank rates:** The asymmetric monetary policy rate corridor offers ample space for interbank operations below the headline policy rate (see figure 10.6). With excess liquidity, the deposit rate has become more relevant. The overnight deposit facility rate was not always fully synchronized with the policy rate, but the

NBRNM has addressed this issue. Overall, the effective monetary policy rate increased by less than the policy rate.

Figure 6. Interbank Market Pass-Through and Excess Liquidity

1/ Effective policy rate is the weighted average of liquidity mopped up by CB-bills, 7-day deposits, and overnight deposits.
Sources: Country authorities, and IMF staff estimates.
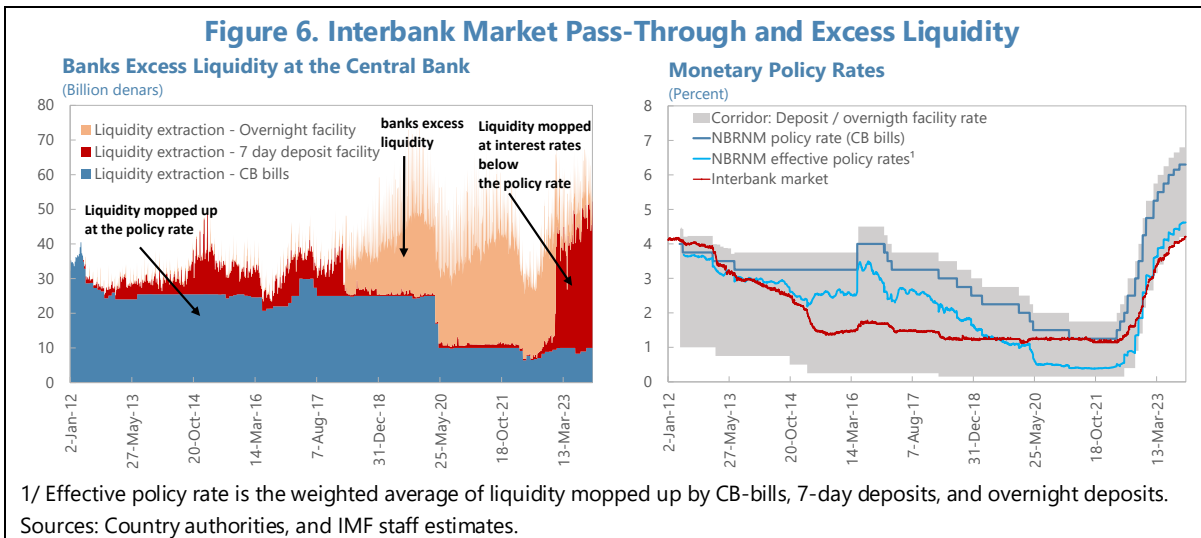
15.   The limited pass-through is also associated with structural issues:

- **With high concentration in the banking system, there is less competition and so less pass-through.** The Herfindahl-Hirschman index (HHI) based on total assets suggests that regional peers that have less concentrated banking systems have higher interest rate pass-through.

Figure 7. Pass-Through and Competition

Source: Country authorities; and IMF staff estimates.

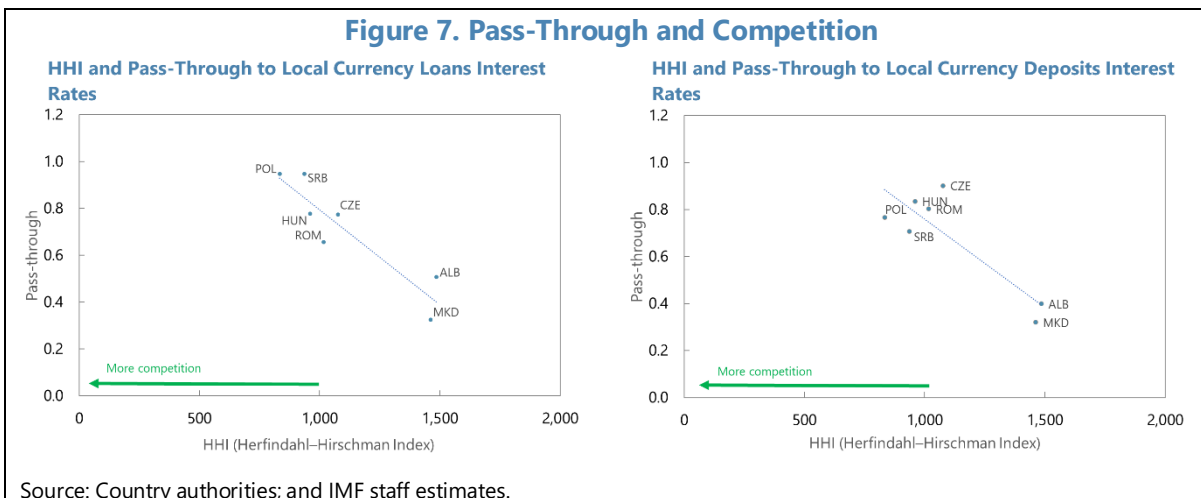- **Legislation that sets caps on retail interest rates for loans.** The penalty interest rate is a de facto cap on interest rates in the country.[5] This rate is determined for each half-year as 8 or 10 percentage points above the level of the NBRNM's policy at the beginning of the 6-month period (reference interest rate). Therefore, banks significantly revise their interest rates every six

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[5] The penalty interest rate is determined for each half-year, 8 or 10 percentage points (for natural persons of legal entities respectively) above the level of the NBRNM's reference interest rate for denars or the one-month Euribor rate for euros, that were effective on the last day of the previous half-year.

months after this cap rate is observed. While it seems lending rates are unaffected, operationally it would be important to update more frequently to ensure flexibility of interest rates.

16. **Despite these structural challenges that take time to be addressed, the NBRNM has room to improve the pass-through of monetary policy.** A key priority will be to recalibrate monetary policy operations to improve the transmission to market rates. This will require a holistic approach, carefully sequencing, and clear communications to avoid disruptions. This strategy should include reducing the CB-bills maturity, increasing the deposit rate facility to narrow the interest rate corridor, streamlining deposit facilities,[6] and improving the auction systems. At the same time, ongoing plans to streamline reserve requirements will help to manage excess liquidity.

Penalty Rate and Domestic Interest Rates
(Percent)
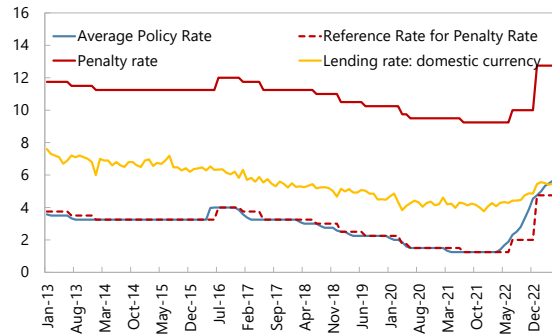
Sources: IMF staff estimates.

Methodological Appendix

Simple Contemporaneous Regressions

Table 2. North Macedonia: Elasticity of Selected Interest Rates to Policy Rates

	N. Macedonia	Selected Regional Peers[1]	Selected Advanced Europe[2]
Interbank rate (LC)	**0.48*****	**0.94*****	**0.94*****
Obs	194	1200	800
R^2	0.29	0.15	0.07
T-bill yield (LC)	**0.46*****	**0.74*****	**0.46****
Obs	190	893	800
R^2	0.10	0.26	0.17
New LC-loans rate	**0.20*****	**0.56*****	**0.53*****
Obs	200	1156	770
R^2	0.04	0.07	0.18
New LC-consumer loans	**0.08**	**0.22****	**0.37****
Obs	200	1049	675
R^2	0.00	0.01	0.04
New LC-mortgages	**0.25***	**0.49****	**0.46*****
Obs	200	1049	770
R^2	0.03	0.03	0.50
New LC-deposit rate	**0.10**	**0.65*****	**0.52****
Obs	200	1156	772
R^2	0.01	0.30	0.42
New FX-loans rate	**0.57****	**0.44*****	**...**
Obs	200	956	...
R^2	0.04	0.02	...
New FX-deposit rate	**0.13**	**0.24***	**...**
Obs	200	956	...
R^2	0.01	0.04	...

Note: Elasticities (β) are estimated as OLS regressions: Δinterest rate = α + βΔmonetary policy rate.
LC = Local currency
Sample 2007M1-2023M9.
*** 97.5 / ** 95 / * 90* percent confidence p-value.
1/ Selected regional peers include Albania, Czech Rep., Hungary, Poland, Romania and Serbia.
2/ Selected advanced Europe include Euro area, Sweden, Switzerland, and United Kingdom.

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[6] Currently NBRNM has two deposit facilities. An overnight deposit facility and a 7-day deposit facility, which in the future, consideration should be given to consolidate them.

Regression Based on Mishra, Montiel, and Spilimbergo (2012)

$$\Delta y_{t,i} = \beta_0 \Delta x_{t,i} + \beta_1 \Delta x_{t-1,i} + \beta_2 \Delta x_{t-2,i} + \gamma_1 \Delta y_{t-1,i} + \gamma_2 \Delta y_{t-2,i} + \varepsilon_{t,i}$$

$$y = \begin{cases} \text{New local curr. loans interest rate} \\ \text{New local curr. consumer loans interest rate} \\ \text{New local curr. mortgages interets rate} \\ \text{New local curr. deposit rate} \end{cases} \qquad x = \text{policy rate}$$

Short term pass-through $= \beta_0$

Long term pass-through $= \dfrac{\beta_0 + \beta_1 + \beta_2}{1 - \gamma_1 - \gamma_2}$

Table 3. North Macedonia: Long Term Elasticity of Selected Interest Rates to Policy Rates—Two-Month Lags

	N. Macedonia	Selected Regional Peers[1]	Selected Advanced Europe[2]
Retail lending rate (LC)	**0.32*****	**0.84*****	**0.79*****
Obs	198	1144	762
R^2	0.16	0.18	0.27
Consumer loans	**0.15**	**0.48*****	**0.56*****
Obs	198	1037	667
R^2	0.00	0.00	0.00
Mortgages	**0.56*****	**0.68*****	**0.66*****
Obs	198	1037	762
R^2	0.00	0.00	0.00
Retail deposit rate (LC)	**0.20****	**1.02*****	**0.75*****
Obs	198	1144	764
R^2	0.09	0.47	0.56

Note: Statistical significance of long term passthrough estimated via boostraping.
LC = Local currency
Sample 2007M1-2023M9.
*** 97.5 / ** 95 / * 90* percent confidence p-value.
1/ Selected regional peers include Albania, Czech Rep., Hungary, Poland, Romania and Serbia.
2/ Selected advanced Europe include Euro area, Sweden, Switzerland, and United Kingdom.

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PRODUCTIVITY COMPETITION[1]
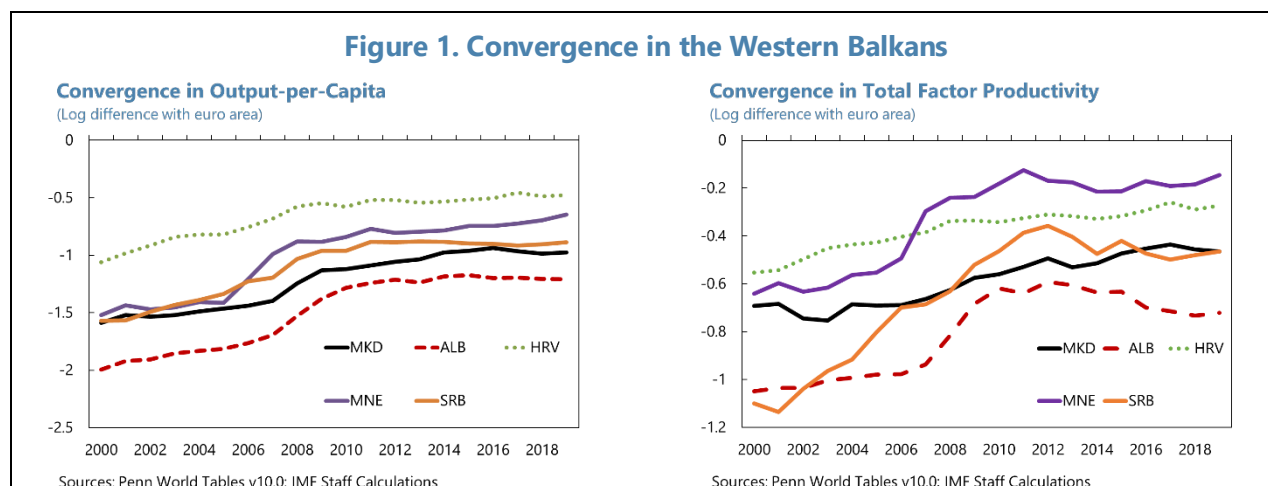
A. Introduction

1.   Output-per-capita growth has been a major driver of improving living standards in North Macedonia over the past two decades, and continued output-per-capita growth is necessary for further gains. This paper starts by examining the drivers in output-per-capita growth in North Macedonia. Over the past two decades, around 90 percent of output-per-capita growth has been driven by increases in labor market participation and productivity, around equal, with the remaining 10 percent driven by increases in capital intensity. Institutional barriers in North Macedonia (e.g., credit constraints, informality, bureaucracy) fall short of advanced economies in several areas, which may result in suboptimal firm-level employment and capital accumulation, lowering aggregate productivity. This paper develops a model of aggregate output-per-capita where aggregate productivity depends on firm dynamics and the allocation of resources across firms. The paper uses the model to quantitatively examine the tradeoffs of several classes of policies designed to encourage the accumulation of resources by productive firms, encourage firm entry and discourage firm exit, as well as increase labor participation and capital accumulation. The paper finds that the greatest area to improve output-per-capita is through improving resource allocations and supporting the business environment.

2.   Sustained growth in output per capita is an important measure of improved living standards and successful economic convergence. Output per capita in North Macedonia ranks in the middle of countries globally and stood at around 38 percent of the European Union in 2019. While other factors (e.g., inequality, pollution) affect the quality of life within a country, growth in output-per-capita is generally considered to be the main driver of improved living standard over time. Given this, the paper focuses on this measure as the main outcome of interest. Additionally, output-per-capita is an important measure of the success of economic convergence of a country over time. Countries with lower output-per-capita are generally able to sustain longer periods of above-average growth due to benefits of technological leap frogging and rapid accumulation of capital.

3.   After a period of catch up, convergence in per capita output in North Macedonia, and the other Western Balkan countries, has slowed over the past decade. While slower than its counterparts, output per capita in North Macedonia gradually converged to advanced economies—as measured by the Euro Area—from 2000 to late 2010s (Figure 1). While output per capita continued to grow into the next decade, convergence stalled, and North Macedonia stopped making progress relative to advanced economies. Convergence in both periods has been hurt by lackluster total factor productivity growth, which has remained stable but low. If this trend continues, slow productivity growth could be a major hinderance on real output growth and delay North Macedonia's aspirations of converging with the standard of living of the Euro Area.

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[1] Prepared by Stephen Ayerst; Bunyada (Mos) Laoprapassorn

Figure 1. Convergence in the Western Balkans

Convergence in Output-per-Capita
(Log difference with euro area)

Sources: Penn World Tables v10.0; IMF Staff Calculations

Convergence in Total Factor Productivity
(Log difference with euro area)

Sources: Penn World Tables v10.0; IMF Staff Calculations

B. Growth Accounting

4.   Understanding the factors inhibiting income convergence in North Macedonia requires a better understanding of the drivers behind output growth. The output-per-capita growth from 2000 to 2019 of 3.7 percent (annualized) on average could be driven by capital accumulation, increased labor participation, and growth in total factor productivity (TFP). In order to assess the contribution of each of these factors to output-per-capita growth, staff decompose growth as follows:

$$\frac{Y}{N} = A^{\frac{1}{1-\alpha}} \left(\frac{K}{Y}\right)^{\frac{\alpha}{1-\alpha}} \left(\frac{L}{N}\right),$$

where Y is output, N is the population, A is total factor productivity, K is capital, L is employment, and α is the relative importance of capital in production.[2] Table 1 summarizes the growth rate from each source and its contribution to output-per-capita growth.[3]

5.   The growth decomposition indicates that output-per-capita growth in North Macedonia over the two decades has been driven by increased labor participation and slow but steady TFP growth. While capital accumulation accounted for 45 percent of growth between 2000 and 2010, the decline in the capital-output ratio from 2010 to 2019 led to a negative contribution to growth in the last decade. Overall, growth in the capital-output ratio—which excludes capital growth driven by productivity growth—accounted for around 10 percent of growth from 2000 to 2019, contributing little to aggregate growth. Meanwhile, labor participation growth has been a consistent contributor to North Macedonia's growth, contributing to about 24 percent of

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[2] Following the literature, the capital share α is set to 0.35. Total factor productivity A in the expression can be calculated using data on output, capital stock, and labor as $A_t = Y_t / K_t^\alpha L_t^{1-\alpha}$.

[3] Censuses were conducted in 2002 and 2021 in North Macedonia leading to a substantial revision in the population and employment in 2021. Annex III examines the potential sensitivity of the results to the population revision. While there are quantitative differences, the main results and conclusions remain qualitatively the same.

growth between 2000 and 2010 and 88 percent between 2010 and 2019, overall accounting for about 46 percent of growth during the whole period. TFP growth is also a significant contributor, accounting for 31 and 70 percent of growth across the respective periods, and overall accounting for about 44 percent of growth from 2000 to 2019. The results from this growth decomposition exercise are consistent with the literature (e.g., Hsieh and Klenow, 2010), which finds that differences in capital accumulation, human capital, and labor participation can explain, at most, around half of the output-per-capita differences across countries. The remaining gap in output-per-capita is attributed to the residual, total factor productivity.

Table 1. North Macedonia: Factors Driving Growth, 2000–19

	2000-2019		2000-2010		2010-2019	
	Growth	Contribution (%)	Growth	Contribution (%)	Growth	Contribution (%)
Output-per-Capita	3.67	100	4.37	100	2.52	100
Capital / Output	0.66	9.7	3.66	45.1	-2.71	-57.9
Labor Participation	1.69	46.1	1.07	24.4	2.21	87.7
Total Factor Productivity	1.05	44.2	0.87	30.5	1.15	70.2

Source: Penn World Tables v10.0; IMF staff calculations

6.   Supporting capital accumulation may help in the short term but is unlikely to be a main engine of convergence in the long run. The capital-output ratio measures the capital intensity of the economy, controlling for the increase in the total capital due to productivity growth. The capital-output ratio stood at around 3.8 in 2019, increasing from around 3.3 in 2000, placing North Macedonia near the middle of the Western Balkan countries. Policy should be careful not to hinder capital accumulation and supporting capital accumulation can help recover some of the lost growth over the 2010-19 period. In particular, investment in public infrastructure (as analyzed by Atoyan et al., 2019) could be especially important as it not only increases the aggregate capital stock but also reduces firms' operational and entry barriers, as will be analyzed in the model later in this paper. However, the capital-output ratio is not strongly correlated with cross-country productivity (Figure 2 left panel) and so it is unclear if further capital accumulation can drive long-run output-per-capita growth.

7.   While labor participation has been a key driver of growth over the past two decades, space for future labor participation growth is likely limited. Labor participation stood at around 41 percent prior to the pandemic (Figure 2, right panel).[4] The increase in labor participation, from 29.4 percent in 2000, contributed to just under half of the growth in output-per-capita over this period.[5] Further, while the participation rate of 41 percent is near the average for the Western Balkan countries, the participation rates of other countries in the region indicate room for further growth. For example, Germany, the Czech Republic, and Hungary have participation rates of nearly

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[4] Labor participation is measured in this exercise as the total employed workers divided by the total population. In this regard, the labor participation recorded here is smaller than in other source where it is measured as either the total labor force (including unemployed) in the numerator or only the working-age population in the denominator.

[5] An important caveat with the growth accounting exercise is that it only captures observed workers and so informal workers may not be captured in the measure. This could bias the contribution of labor participation if, for example, there is a shift from informal to formal employment over this period.

50 percent. That said, further growth in the participation rate is finite and cannot be a main driver of growth at longer horizons.

8.   Accelerating TFP growth is necessary for long-run convergence with advanced economies. The cross-country comparison (Figure 2) indicates that there is some room for North Macedonia to increase output per capita through capital accumulation and higher labor participation. Without TFP growth however, North Macedonia would require among the highest capital-output and labor participation in the world to close the remaining 62 percent gap (i.e., moving from the current 38 percent output per capita to parity). Further, these increases would almost certainly have adverse welfare implications due to the drain on consumption to support investment, and increased working hours. Instead, increasing total factor productivity offers a clearer and more sustainable path for output-per-capita convergence. The remainder of this paper explores the factors surrounding TFP growth and how policy may be designed to support TFP.
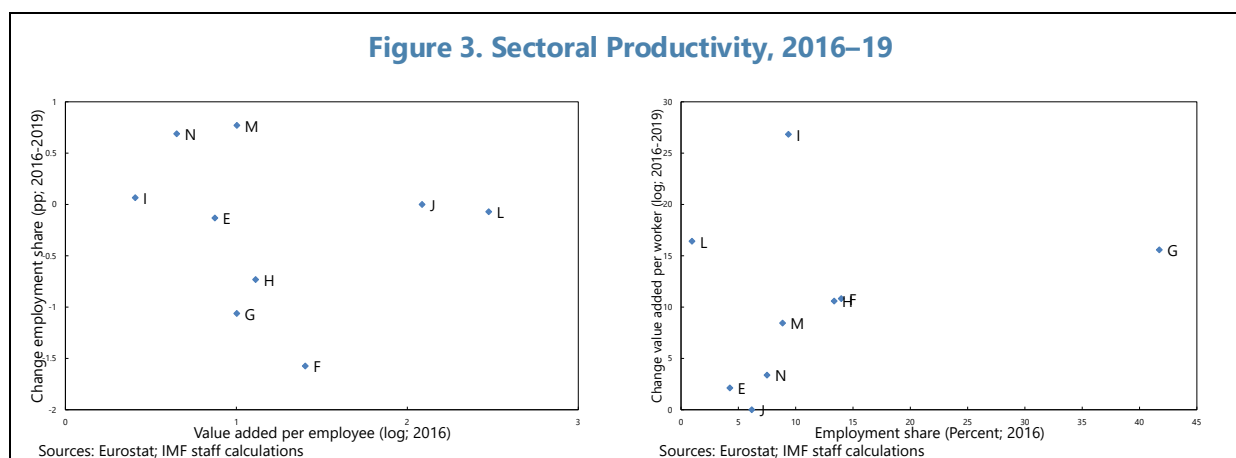

Figure 2. Labor Participation and Capital-Output Across Countries
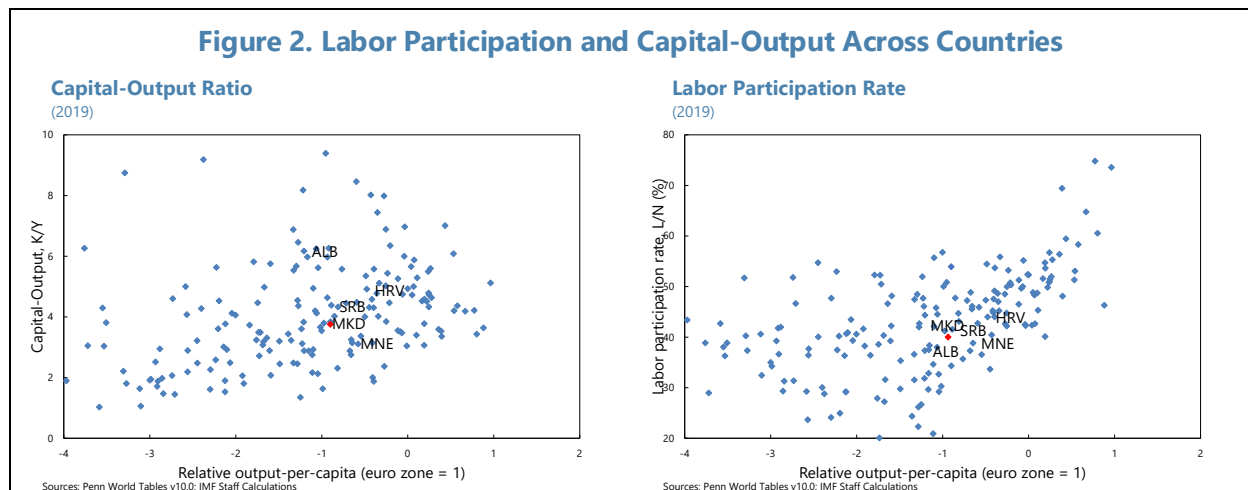
C.   TFP Growth

Factors Driving Per Capita Output Growth in North Macedonia

9.   TFP growth has driven just under half of output-per-capita growth over the past two decades and remains the clearest source of sustained growth in the future. Sectoral re-allocations have had a limited role in productivity growth, albeit data is limited. Allocative efficiency of employment and capital appear to be severely distorted relative to advanced economies. This is evident by firms accumulating capital and employment more slowly than productivity over their lifecycle.

10.   Sectoral shifts have had very little impact on aggregate productivity over the recent period. Figure 3 shows the change in employment and change in value added per employee of sectors in North Macedonia. While the analysis is limited to the 2016 to 2019 period—a shorter-than-optimal period to observe sectoral reallocation—due to limited data availability, preliminary results do not show a strong reallocation of workers towards higher productivity sectors (left panel). Larger sectors did however tend to experience higher increase productivity than smaller sectors

(right panel). Overall, the results suggest that sectoral shift may not be the main driver behind the increase in aggregate productivity in North Macedonia and calls for a closer examination of the changes at the firm level.

Figure 3. Sectoral Productivity, 2016–19

Sources: Eurostat; IMF staff calculations

Sources: Eurostat; IMF staff calculations

11.   Allocative efficiency across firms in North Macedonia hinders aggregate productivity.
Understanding allocative efficiency across firms, which can significantly impact aggregate productivity, requires firm-level data. Table 2 reports the relationship between employment and capital and firm-level productivity in North Macedonia and,[6] for comparison, France using firm-level data from Bureau Van Dijk's Orbis database, described in Annex II. While employment is generally allocated in line with firm productivity, the elasticity of employment (around 0.29) to productivity is significantly smaller than in advanced economies. To provide a comparison, the elasticity in France is around 0.87, three times larger than in North Macedonia. The low elasticity in North Macedonia implies that while more productive firms tend to employ more workers, they are not employing nearly enough to take advantage of their productivity, indicating suboptimal allocation of resources across firms. The elasticity of capital with respect to firm-level productivity is around 0.21, implying that capital is even more distorted.

	North Macedonia		France	
	log(Employment)	log(Capital)	log(Employment)	log(Capital)
log(TFP)	0.286	0.208	0.867	0.466
	(0.00120)	(0.00352)	(0.00066)	(0.00103)
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes

Table 2. North Macedonia: Factor Allocations in North Macedonia

Sources: Orbis; IMF staff calculations.

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[6] Firm-level productivity is estimated following Hsieh and Klenow (2009).

12. **Firms accumulate employees and capital as they grow older but at a slower rate than they become more productive.** Table 3 reports the dynamics of firm-level productivity, employment, and capital as firms age.[7] Over a year, a typical firm will on average increase productivity by around 5 percent but only increase its employment and capital inputs by around 3 percent, indicating that they are accumulating employees and capital more slowly than socially optimal. This suggests that aggregate productivity is hindered by the rate of resource allocation across firms.

Table 3. North Macedonia: Firm Lifecycle			
	log(TFP)	log(Employment)	log(Capital)
age	0.0491	0.0278	0.0335
	(0.001127)	(0.000969)	(0.00161)
age^2	-0.00067	0.00004	0.00051
	(0.000035)	(0.000033)	(0.000053)
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Sources: Orbis; IMF staff calculations			

13. **Aggregate productivity could also be fostered by allocating resources to young and more productive firms, who tend to have faster TFP growth.** The average TFP growth rate of firms over the sample data is around 3.4 percent.[8] Table 4 indicates young firms tend to have faster TFP growth, with an increase in firm age by one year corresponding to TFP growth falling by around half the average growth rate, although this effect does diminish as firms become older. The table also indicates that a one log-point increase in firm's TFP corresponds to faster TFP growth rate of firm by around 8 percentage points, although this effect also declines for more productive firms. The results highlight that firm productivity tends to follow a systematic pattern both as firms age and in the cross section of firms. Importantly, this implies that the allocative efficiency of employment and capital is not purely the result of transitionary factors. This also suggests that policies should focus on improving growth outcomes and resource allocations to young and productive firms that are the most dynamic in the economy.

Table 4. North Macedonia: Firm Growth			
	Growth TFP		Growth TFP
age	-1.47	log TFP	11.11
	(0.0624)		(0.0011)
age^2	0.03	(log TFP)^2	-2.65
	(0.0017)		(0.0640)
Year FE	Yes		Yes
Sector FE	Yes		Yes
Sources: Orbis: IMF staff calculations			

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[7] Age is measured as the number of years since the firm's date of incorporation.

[8] Growth TFP is calculated as $100 * (TFP_{i,t} - TFP_{i,t-1})/(0.5 * (TFP_{i,t} + TFP_{i,t-1}))$ which bounds growth in the range $[-200,200]$ to minimize the influence of outliers.
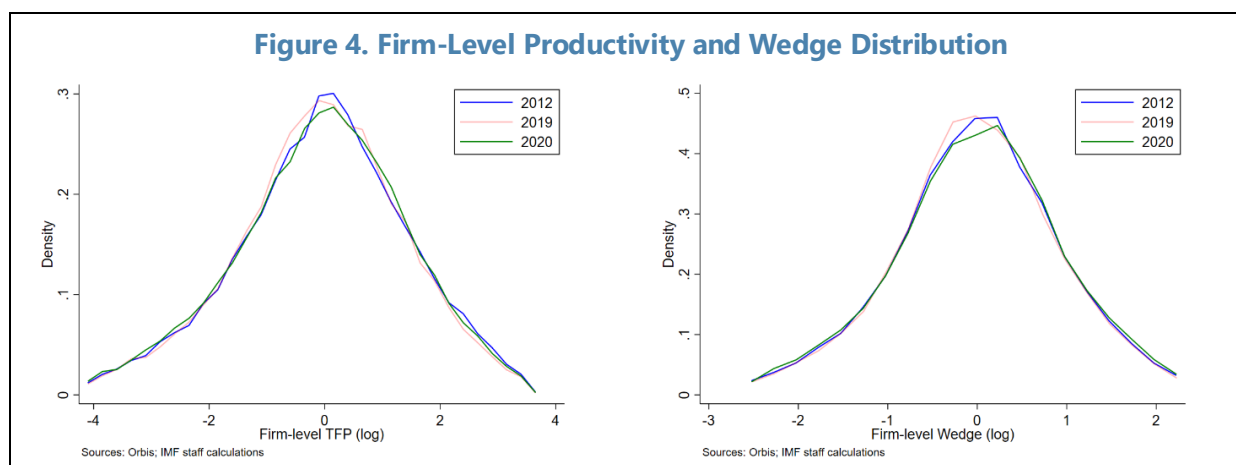
Model

To understand the drivers of aggregate output-per-capita growth, staff develop a structural model of the North Macedonian economy that incorporates labor participation, capital accumulation, and resource allocation barriers.

14.   To further understand the drivers of productivity, we develop a structural model of firm productivity and factor allocations. The model endogenizes aggregate productivity as depending, in part, on the allocative efficiency of capital and labor used by firms.[9] In the model, firms produce goods using labor ℓ, capital k, and production technology z. Households provide labor subject to income taxes received on labor τ_t^L (e.g., lack of support for childcare) and capital accumulation (e.g., credit constraints) while firms face barriers to entry τ_t^E (e.g., excessive delays to registering a business), barriers to operation τ_t^f (e.g., excessive regulations), and idiosyncratic production barriers (e.g., larger firms facing higher scrutiny from auditors). The idiosyncratic production barriers are parameterized by an elasticity of distortions ρ to firm-level productivity z, where higher elasticities imply that more productive firms face higher barriers, as in the data. The model also provides a framework to compare the first-best and market allocations of capital and labor as well as a tool to convert the allocative efficiency of the economy into an aggregate productivity cost. For further details on the model, see Annex I.
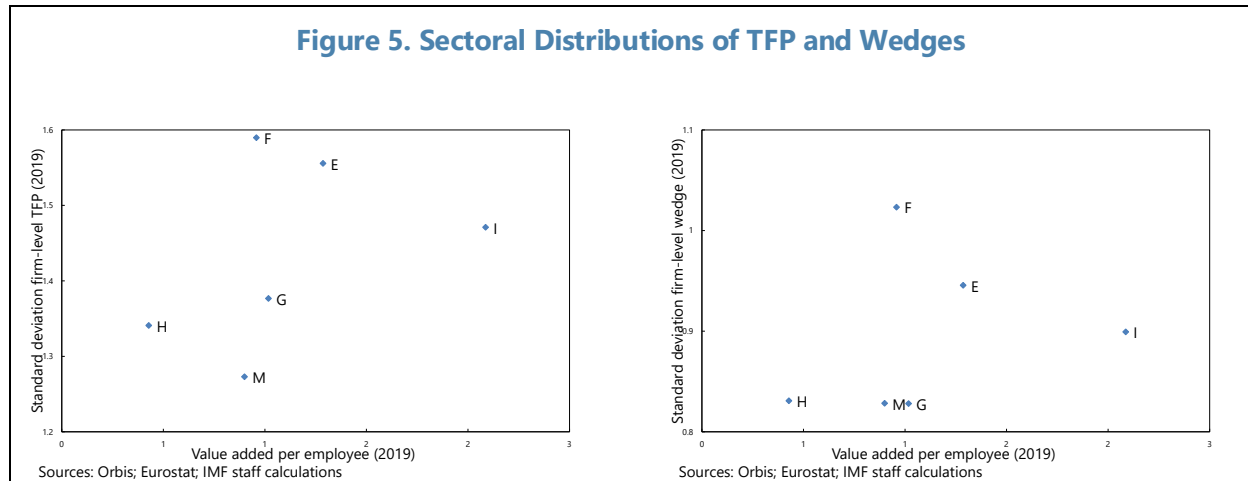
Mapping Model to Data

15.   Measurement of key variables. Firm-level productivity and production barriers (wedges) are calculated as in Hsieh and Klenow (2009), described in Annex II. The production barrier captures the wedge between employment and capital in the data and the model-implied optimal allocation. Higher dispersion in the wedges implies that the allocation of capital and labor is more severely distorted relative to the optimal allocation.[10] Figure 4 reports the distribution of firm-level TFP and wedges in the data for three periods.

Figure 4. Firm-Level Productivity and Wedge Distribution

Sources: Orbis; IMF staff calculations

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[9] The model extends Restuccia and Rogerson (2008) and Hsieh and Klenow (2009) to incorporate labor supply by households and richer firm dynamics. The firm dynamics allow for entry, exit, and firm size to be examined.

[10] The average level of wedges does not have meaning since the total stock of aggregate labor and capital are employed in equilibrium.

16. **Sectoral differences in misallocation are comparatively minor.** Dispersion in log productivity within sectors ranges from around 1.2 in professional services to around 1.6 in trade, see Figure 5. Dispersion in wedges range from around 0.8 to 1.0 with a close relationship between the dispersion in productivity and wedges. Given this, the proceeding analysis focuses on economy-wide reallocation rather than between- or within-sector reallocations.

Figure 5. Sectoral Distributions of TFP and Wedges

Sources: Orbis; Eurostat; IMF staff calculations

Sources: Orbis; Eurostat; IMF staff calculations

Policy Experiments

17. **The model is calibrated to approximate firm-level productivity and aggregate conditions in the North Macedonian economy** (see Annex I). The model is used to examine five different policies related to barriers on labor participation, capital accumulation, resource allocations, entry of new firms, and exit of incumbent firms that reflect a range of institutional distortions.

18. **Using the quantitative model, staff assess potential policy responses.** The model provides structure to firm dynamics and the labor market in North Macedonia that allows staff to examine how policies may impact the aggregate economy. Staff consider five experiments related to different model barriers. The experiments are disciplined so that the fiscal impact is broadly consistent across experiments (around one percent of GDP). Table 5 summarizes examples of policies and institutional distortions that are related to the broader barriers in the model. Examples of the barriers are linked with individual barriers in the model. However, it is important to note that many of these barriers are related to multiple barriers in the model. For example, reducing credit constraints of young entrepreneurs may promote capital accumulation (capital barriers), may improve the allocative efficiency of capital (production barriers), and may make firms less likely to exit the economy (operational barriers) by allowing firms to better leverage productivity.

a. **Entry barriers.** The first policy experiment is to reduce the entry cost of firms through the entry barrier τ^E. The lower cost of entry allows more firms to enter the economy. The entry barrier captures policies that prevent, or make it more costly, for new firms to enter the market. This could capture, for example, bureaucracy that makes it costly or time consuming to register new businesses.

b. **_Size-dependent production barriers._** The second policy experiment is to reduce the elasticity of distortions with respect to firm-level productivity ρ by around one third of the measured gap between North Macedonia and France. This would increase the elasticity of employment and capital with firm TFP by around one-third of the gap between North Macedonia and France reported in Table 2. Reducing the elasticity of distortions allows more productive firms to accumulate more capital and hire more workers. The most direct example of these policies would be size-dependent taxation or regulation that encourages firms to remain small or informal. However, the elasticity could also capture indirect policies that prevent firms from accumulating capital or employees. Some examples would include credit constraints, which prevent young and productive firms from accumulating capital, or hiring and firing costs, which make it difficult for firms to adjust employment in response to business opportunities.

c. **_Operational barriers._** The third policy experiment is to lower the operational cost of firms through the operational wedge τ^f. Lower operational costs make firms more profitable and lower the probability that firms choose to exit. The operational barrier captures policies that encourage firms to exit the market. This could include, for example, uncertainty around the political and institutional setting that make firms more likely to exit.

d. **_Capital barriers._** The fourth policy experiment is to support the accumulation of capital through lowering the capital wedge τ^K. This allows households to accumulate more capital and rent to firms at a lower cost. The lower capital cost also increases firm profitability. The capital barriers could capture policies or institutional barriers that prevent the accumulation of capital. For example, this would include barriers to public investment or foreign FDI.

e. **_Labor participation._** The final policy experiment is to support the entry of new labor participants through increasing the net wages received by households through lower barriers τ^L. This increases the net salary of households encouraging households to supply more labor than in the benchmark economy. The experiment is directly related to reducing income taxes received on labor. However, the wedge could also be considered more broadly to include barriers to households joining the labor market, such as, for example, relevant skills or childcare.

Table 5. North Macedonia: Model Wedges and Related Policies

Model Barrier	Examples of Barriers
Entry Barriers	Excessive bureaucracy; regulation avoidance by remaining informal; anti-competitive practices by large firms; lack of market information; lack of appropriate entrepreneurial skills or information
Size-Dependent Barriers	Size-dependent taxation or benefits thresholds; taxation of excessive profits; credit constraints on young or productive firms; restrictive hiring or firing costs; increased scrutiny from auditors of large firms; competition from informal firms
Operational Barriers	Uncertainty around business or political environment; poor public infrastructure; export barriers; lack of skilled workforce; labor market rigidities such as hiring or firing costs and excessive worker benefits
Capital Barriers	Credit constraints; lack of financial markets; poor maintenance of public infrastructure; uncertainty around business and political environment; poor project selection or management
Labor Participation	Excessive salary taxation; lack of support for childcare or healthcare; lack of appropriate or insufficient skills; insufficient training; lack of job information

19.   While all of the policies improve productivity, the channels through which they work and the sensitivity of aggregate outcomes differs, as discussed below in order of effectiveness. Table 6 summarizes the quantitative impact of the policy experiments.

a. *Entry barriers.* Lowering the entry barriers primarily works through increasing the number of firms operating in the economy. This has an offsetting impact by also increasing the exit rate since the average firm becomes smaller and less profitable. The net impact of the policy experiment is to increase output per capita by around 16.4 percent and aggregate total factor productivity (TFP) by around 10.2 percent.

b. *Size-dependent production barriers.* Lowering the elasticity of production barriers with respect to firm productivity can be one of the most effective methods of increasing aggregate productivity. Increasing the elasticity allows highly productive firms to accumulate capital and hire more employees. This shift towards high-productivity firms raises aggregate TFP by around 10.2 percent. Additionally, lowering the size dependence of production barriers also helps encourage firms to enter and lowers the exit rate by making large firms more profitable. Together with higher aggregate TFP, this results in output per capita increasing by 14.5 percent relative to the baseline economy.

c. *Operational Barriers.* Lowering the operational barriers also results in more firm entry since firms become, in expectation, more profitable over their lifetime. Unlike entry barriers, lowering operational barriers helps to lower the exit rate since firms become less likely to

exit when they receive a negative shock. The lower exit rate of new firms results in aggregate TFP increasing by around 6.4 percent and output per capita increasing by around 9.1 percent.

d. **Capital Barriers.** Lowering capital costs results in a higher capital-output ratio as households invest more in the aggregate capital stock. This also results in higher profits for firms, due to lower capital costs, incentivizing firm entry and lowering the exit rate, since firms are more willing to continue operations when they receive a negative shock. Overall, the entry of new firms increases aggregate TFP by around 0.1 percent but the primary impact on output is through the higher accumulation of capital of around 1.2 percent. The net impact is to increase output per capita by around 0.6 percent.

e. **Labor Participation.** Lowering the labor wedge results in a higher participation rate of around 0.1 percentage point relative to the benchmark economy. The increase in labor participation raises aggregate output by around 0.1 percent and encourages the entry of firms, which also increases aggregate TFP, albeit very marginally. That said, one should note that certain policies, such as parental leave and flexible work arrangements, can also be effective at encouraging workers to participate and is currently not captured by the model.
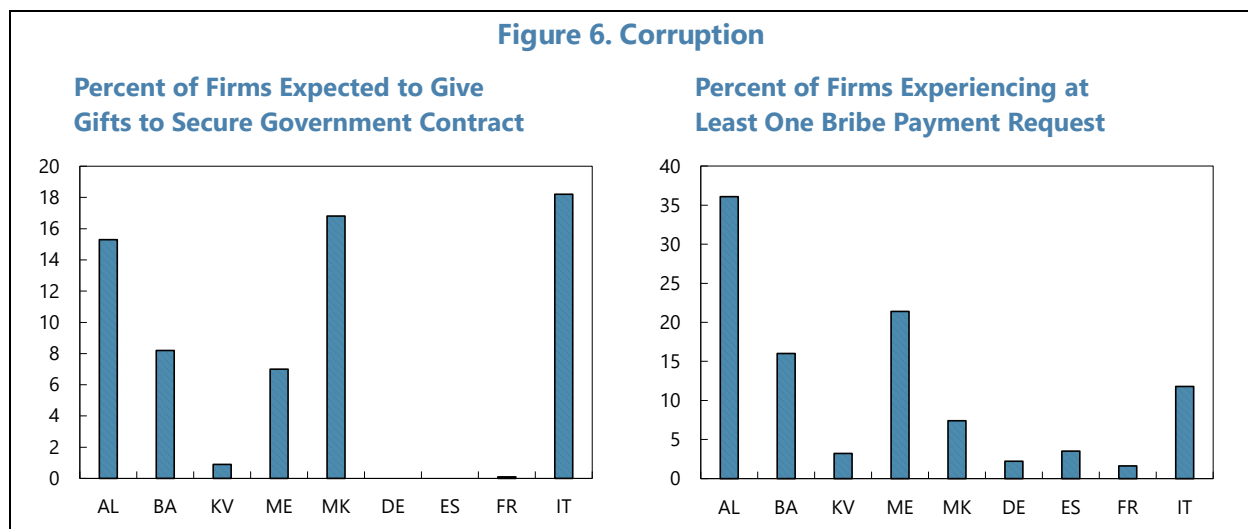
Table 6. North Macedonia: Policy Experiments						
Experiment	Outcome (Relative to Benchmark Economy)					
	Output-per-Capita	TFP	Participation Rate	Capital-Output Ratio	Number of Firms	Exit Rate
	% chg	% chg	pp chg	% chg	% chg	pp chg
Entry Barriers	16.4	10.2	1.0	0.0	59.4	31.5
Size-Dependent Barriers	14.5	10.2	0.0	0.0	18.7	-1.0
Operational Barriers	9.1	6.4	0.0	0.0	39.0	-2.3
Capital Barriers	0.6	0.1	0.0	1.2	0.6	-0.2
Labor Barriers	0.1	0.0	0.1	0.0	0.2	0.0

Barriers to TFP Growth in North Macedonia

Recognizing the gains from improving allocative efficiency and the business environment in the policy experiments above, this section takes stock of barriers to TFP growth in North Macedonia. Compared with regional peers and advanced economies, North Macedonia's performance is mixed, exceeding in some measures and falling short on others, indicating that improvements could be made to foster aggregate productivity growth.
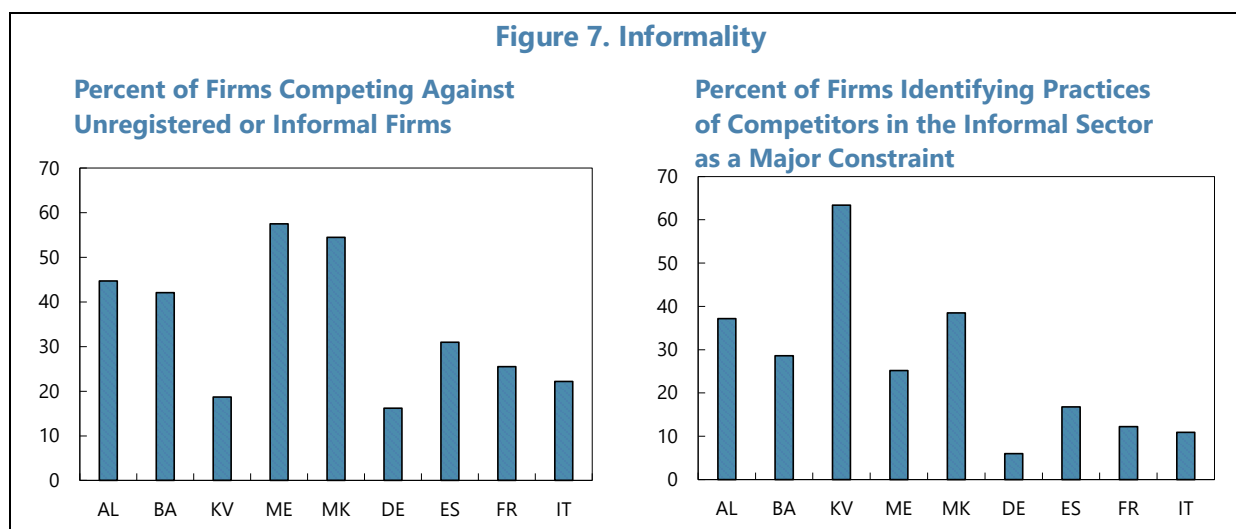
20. **Corruption remains a challenge for operating businesses and efficient allocation of resources, contributing to inefficiencies.** The World Bank Enterprise Surveys suggest that

corruption could be one of the constraints that firms face. In North Macedonia, 16.8 percent of the firms in the sample reported that they were expected to give gifts to secure a government contract (Figure 6, left panel), the highest among the Western Balkans region and higher than France, Germany, and Spain. The percent of firms experiencing at least one bribe payment request (Figure 6, right panel) is lower relative to some other countries in the Western Balkans, but still higher than France, Germany, and Spain. The prevalence of corruption could, in some cases, act as a barrier to entry, and also distort resources towards older firms or firms with more political connections, thereby resulting in inefficient allocation of resources and hindering productivity growth. As shown by the policy experiments, reducing these barriers could be some of the most effective methods of increasing aggregate economic activity. The potential gain from decreasing corruption can therefore be significant, especially if the degree of corruption faced by firms are size dependent.

Figure 6. Corruption

Percent of Firms Expected to Give Gifts to Secure Government Contract

Percent of Firms Experiencing at Least One Bribe Payment Request

21.   Informality is another important factor inhibiting productivity growth. Informality, which is difficult to estimate but constitutes from 20 to 40 percent of economic activity in North Macedonia (EBRD 2019), could be a challenge to productivity growth in several ways. First, if informality is the result of lack of access to finances or avoiding government regulations, informal firms will tend to remain small and limit their contribution to aggregate output. Second, if informality is the result of decisions to avoid taxes and regulations, informal firms could undercut the prices of formal firms, limiting resources and market opportunities from more productive firms. The results from the World Bank Enterprise Surveys suggest some evidence of how informality impacts growth through the second channel. About 54.5 percent of the firms in the World Bank Enterprise Surveys report competing against unregistered or informal firms (Figure 7, left panel)— the second highest among the Western Balkans countries and much higher than EU4. A significant share of firms also identified practices of competitors in the informal sector as a major constraint (Figure 7, right panel). Although this is in line with some other countries in the Western Balkans, the challenge is greater than average in EU4. As informality leads to distortions between productive and unproductive firms, reducing informality has potential to yield significant improvements in aggregate productivity, as suggested by the reduction in entry barriers, operational barriers, and size-dependent production barriers in the model. It is also worth noting that reducing informality

can benefits the scope for policies that improve labor participation as informal workers are unlikely to benefit from policies (e.g., reskilling) targeted at unemployed workers.

Figure 7. Informality

Percent of Firms Competing Against Unregistered or Informal Firms

Percent of Firms Identifying Practices of Competitors in the Informal Sector as a Major Constraint

22.   Some areas of bureaucracy are a challenge to productivity growth. Results from the World Bank Enterprise Surveys indicate mixed results on the hindrance of bureaucracy. On the one hand, results from the latest available surveys indicate that the amount of time senior management spent dealing with requirements of government regulation and the number of days taken to obtain operating license in North Macedonia (lower panels of Figure 8) is relatively low compared to other Western Balkans countries and EU4. On the other hand, the numbers of days taken for firms to obtain construction-related permit or to clear imports from customs are high relative to other countries in the Western Balkans, though still lower than EU4. Overall, the results indicate that bureaucracy in certain areas are still high in North Macedonia relative to peers, which could heighten entry and operational costs for firms and negatively impact productivity growth. Therefore, there is room to reduce entry and operational barriers for firms by decreasing bureaucracy, which can yield nonnegligible improvements in aggregate productivity as indicated by the policy experiments from the model.

23.   Credit constraints hinder capital accumulation of the economy as a whole and the allocative efficiency of firms within the economy. North Macedonia has the largest shares of firms that report being fully credit constrained and a comparatively high share of partially credit constrained firms compared with others in the region and the EU4 (Figure 9). The prevalence of credit constraints could lead to both lower-than-optimal use of capital and smaller-than-optimal size of some firms, leading to allocative inefficiencies and hindering productivity growth. While the gains from capital accumulation alone are comparatively small, credit constraints also impact the allocative efficiency of capital across firms and can hinder operation decisions of firms, suggesting larger potential costs.
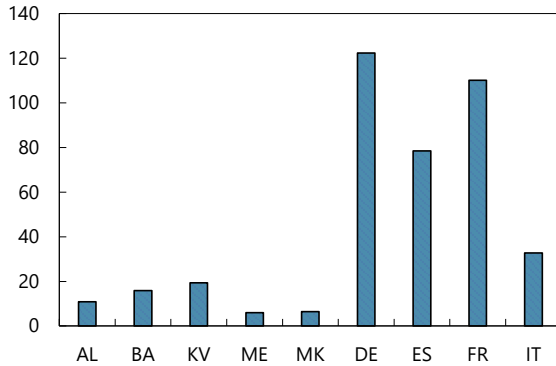
Figure 8. Bureaucracy

Number of Days to Obtain Construction-Related Permit
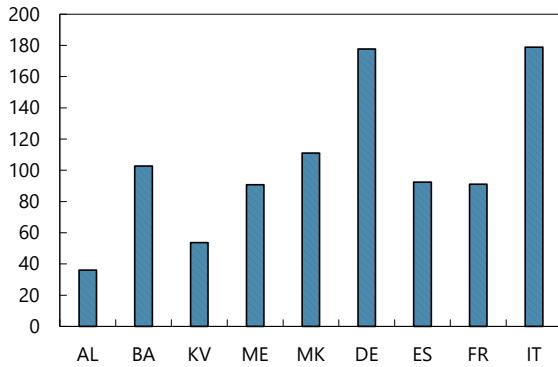
Number of Days to Clear Imports from Customs
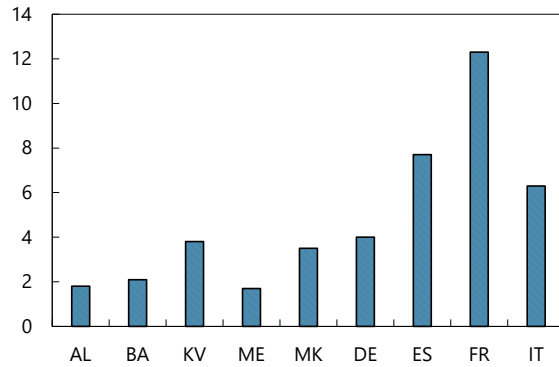
Number of Days to Obtain Operating License

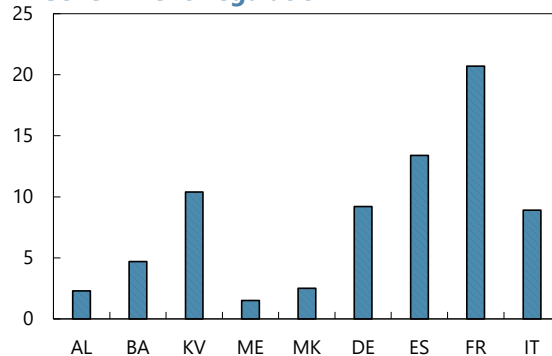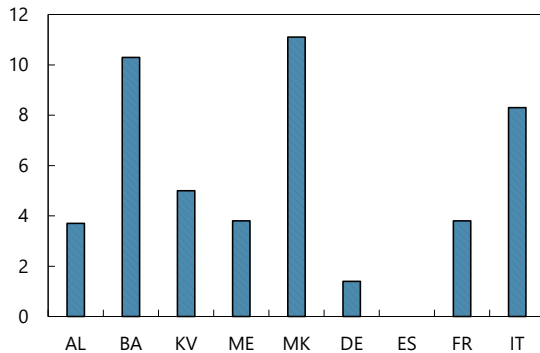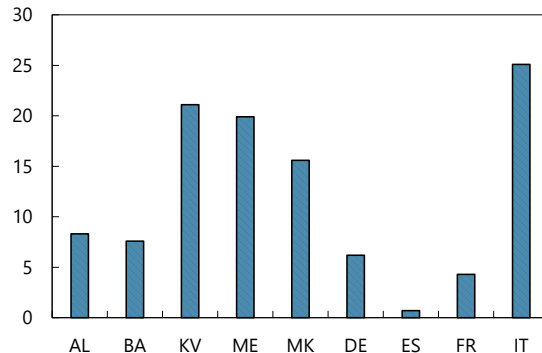**Senior Management Time Spent Dealing with the Requirements of Government Regulation**

Figure 9. Credit Constraints

Percent of Firms That Are Fully Credit Constrained

Percent of Firms That Are Partially Credit Constrained

D.   Conclusions

24.   Incentivizing labor participation and capital accumulation can increase output but are unlikely to drive growth in the long run. While increased labor participation has been an important source of output growth, the evidence is mixed on this as a source of future growth. Some countries (e.g., Czech Republic, Germany) have higher labor participation rates than North Macedonia while others are comparable (e.g., France). The quantitative model shows that increasing labor participation through direct policy intervention would have a limited effect on output. That said, the model neglects non-pecuniary barriers (e.g., skill mismatches) that may be addressed with policy and have a greater impact than the direct intervention modeled. Similarly, capital accumulation should grow with productivity naturally as the economy develops. Efforts to increase capital accumulation through policies could be expensive, and it is unclear that there is substantial room to increase long-run growth through this channel. That said, hinderances to capital accumulation, especially those that effect firms unequally, can damage output growth and lower aggregate productivity. Further, it is worth noting that the model considers only the aggregate stock of capital. Some forms of capital, in particular public infrastructure, may have larger benefits than in implied by the policy experiments.

25.   Increasing allocative efficiency across firms and improving the business environment can substantially increase aggregate output and productivity. Allocative efficiency in North Macedonia has a major cost to aggregate productivity and can be a barrier to development moving forward. Financial development, bureaucracy, and informality are all policy-relevant areas that could be tackled to improve the allocative efficiency of firms. High entry and operation costs also appear to be an area that policy can target in North Macedonia. These barriers may relate to indirect factors, such as bureaucracy and corruption, that weigh on firms' ability to operate unconstrained. Improving aggregate productivity is a multi-faceted problem and policies should be designed with all barriers in mind. For example, improving access to credit for small firms is likely to increase allocative efficiency, lower operational barriers (as firms are able to better leverage productivity), and promote the aggregate accumulation of capital. Similarly, improving the skill matching of labor is likely to increase allocative efficiency by allowing productive firms to find the right employees, lower the entry barriers by improving access to skills, and promote labor participation.

Annex I. Model Details and Calibration

This Annex provides details of the model described in the main text along with a summary of the model equilibrium and properties.

Economic Environment

1.   **Preferences and households.** Households consume a final consumption good and supply labor. Households have preferences given by:

$$U = \sum_t \beta^t \left[\log C_t - \chi \frac{L_t^{\zeta+1}}{\zeta + 1} \right],$$

where β is the household's discount rate. There is a number N_t of households that supply L_t units of labor to the market in exchange for an adjusted market wage $(1 - \tau_t^L)w_t$ where w_t is the market wage rate and τ_t^L is barrier to labor participation. Additionally, households own the capital stock K_t and rent capital to firms in exchange for the market rate r_t. Households accumulate new capital through investment X_t according to $K_{t+1} = X_t/\tau_t^K + (1 - \delta)K_t$, where τ_t^K is a barrier to capital accumulation and δ is the depreciation rate of capital.

2.   **Final production good.** The final good is produced by a representative firm using intermediate goods i produced by individual firms from different sectors s. The production technology is:

$$Y_t = \left[\sum_s \left(\sum_{i=1}^M y_{i,t} \right)^{\frac{1}{\eta}} \right]^{\eta}$$

where M is the total number of goods produced and η is a parameter determining the elasticity of substitution between sectors s. This is for illustrative purposes and the elasticity is set $\eta = 1$ in the calibration, such that sector goods are perfect substitutes. Each good is produced by a unique firm, such that M is also the number of firms in the economy.

3.   **Intermediate firms.** Goods are produced using capital k, labor ℓ, and a production technology z that is unique to the firm. The production technology of a firm i is given by:

$$y_{i,t} = z_{i,t}^{1-\gamma} \left(k_{i,t}^\alpha \ell_{i,t}^{1-\alpha} \right)^\gamma.$$

Firm production technology follows a Markov process given by $z_{i,t+1} = \theta z_{i,t} + \varepsilon_{i,t}$ and $\varepsilon_{i,t} \sim N(0, \sigma_\varepsilon^2)$. Firms pay a fixed operational cost $(1 + \tau_t^f)f$ to remain active, where f represents a fundamental operational cost (e.g., overhead labor) while $1 + \tau_t^f$ represents barriers to operations of existing firms (e.g., excessive regulation).

4.   **Entry and exit.** Firms exit at exogenous rate λ or endogenously when it is no longer profitable for firms to remain active. New firms enter by paying cost $(1 + \tau_t^E)\psi$. Similar to operational costs, ψ captures a fundamental entry cost (e.g., developing an idea, opening a location)

while $1 + \tau_t^E$ captures entry barriers (e.g., excessive delays to registering a business). The number of firms in the economy in period t is equal to

$$M_t = (1 - \lambda)\bar{a}_t M_{t-1} + M_{E,t},$$

where $\bar{a}_t$ is the share of firms that choose to remain active in period t and M_t^E is the number of new firms that enter the economy.

5. **Institutional setting**. The production barriers are modeled indirectly through idiosyncratic taxes $\tau_{i,t}$ on firm revenues (as in Restuccia and Rogerson, 2008). These taxes act as a wedge between the firm's first-best allocation that would be achieved in the absence of distortions and the market allocation observed in the data. Firm profits are given by:

$$\pi_{i,t} = (1 - \tau_{i,t})p_{i,t}y_{i,t} - w_t \ell_{i,t} - r_t k_{i,t} - (1 - \tau_t^f)f.$$

The wedge is assumed to follow $\log(1 - \tau_{i,t}) = \rho \log z_{i,t} + v_{i,t}$ where $v_{i,t} \sim N(0, \sigma_v^2)$. The elasticity of wedges ρ captures the size dependence of production barriers—i.e., how much institutions in the economy dampen productive firms—while the idiosyncratic component $v_{i,t}$ captures the mismatch in factor allocations and firm productivity.

6. **Government.** There is a passive government that collects the implicit tax revenues (from the barriers) and redistributes to households as a non-distortionary lump-sum transfer. This ensures that the market clearing condition holds in equilibrium.

Model Derivations

In what follows, firms are referred to by their type (z, τ) instead of index i.

7. **Equilibrium Definition.** A stationary competitive equilibrium consists of the values $\{r, w, C, K, L, T, M, M_E, V_E, k(z, \tau), \ell(z, \tau), \Phi(z), V(z, \tau)\}$ for values of z and τ such that: (i) Households choose C, K, and L to maximize utility; (ii) Firms choose (k, ℓ) to maximize profits; (iii) Firms choose to exit when value is negative; (iv) new firms enter to maximize entry value; (v) The distribution $\Phi(z)$ of productivities is determined by firm entry and exit decisions; (vi) the government's budget is balanced; and (vii) final good, labor, and capital markets clear.

8. **Household's Problem.** The representative household chooses to maximize consumption, labor supply, and investment to maximize utility. The household's problem is given by:

$$U(K) = \max_{C, K', L} \log C - \chi \frac{L^{\zeta+1}}{\zeta+1} + \beta U(K')$$
$$s.t. \quad C + \tau^K[K' - (1 - \delta)K] + E' = (1 - \tau^L)wL + rK + RE + T$$

where T is a lump-sum transfer from the government and E is the household's ownership of equity in firms. This implies the Euler equations $R = 1/\beta - 1$ and $r = \tau^K(1/\beta - 1 + \delta)$. The supply of labor is given by:

$$L^S = \left(\chi \frac{(1-\tau^L)w}{C}\right)^{\frac{1}{\zeta}}.$$

9.   **Firms' Problem.** The static problem of a firm is to maximize profits by choosing capital and labor inputs. The profits of a firm are given as the solution to:

$$\pi(z,\tau) = \max_{k,\ell}(1-\tau)z^{1-\gamma}(k^\alpha \ell^{1-\alpha})^\gamma - rk - w\ell - (1+\tau^f)f.$$

Solving the above problem implies that capital and labor inputs are equal to:

$$\begin{aligned}
k(z,\tau) &= \left[\frac{\alpha\gamma}{(1+\alpha\gamma}\left(\frac{1-\alpha}{w}\frac{r}{\alpha}\right)^{(1-\alpha)\gamma}\right]^{\frac{1}{1-\gamma}}(1-\tau)^{\frac{1}{1-\gamma}}z \\
\ell(z,\tau) &= \left[\frac{}{w}\left(\frac{w}{1-\alpha}\frac{}{r}\right)\right]^{\alpha\gamma}(1-\tau)^{\frac{1}{1-\gamma}}z.
\end{aligned}$$

Both capital and employment are increasing in firm-level productivity z and decreasing in the wedge $1/(1-\tau)$.

The value of a firm depends on the profits that the firm earns in the current period and the expected continuation value. Firms choose to exit when the value of the firm is no longer positive. The value of a firm can be written as:

$$V(z,\tau) = \max\left\{0, \pi(z,\tau) + \frac{1-\lambda}{1+R}\mathbb{E}_{z',\tau'}V(z',\tau')\right\}.$$

Let $a(z,\tau)$ take value one if a firm with productivity z and production barrier τ chooses to remain active and zero otherwise.

The entry problem is to maximize the entry rate x in order to maximize the expected net value of entry, given by:

$$V_E = \max_x -(1+\tau^E)\psi x + x\int_{z,\tau} V(z,\tau)g(\tau|z)h(z).$$

10.   **Firm Distribution.** The firm distribution is described by the law of motion:

$$\Phi_{t+1}(z) = H_E(z) + (1-\lambda)\int_{z'} \bar{a}(z)H(z|z')\phi_t(z')dz'$$

where $H_E(z)$ is the probability an entrant has productivity less than or equal to z, $H(z|z')$ is the probability that a firm with productivity z' transitions to a productivity equal to or less than z, $\bar{a}(z) = \int_\tau a(z,\tau)d\tau$ is the average probability that firm with productivity z remains active, and $\phi_t(\cdot)$ is the PDF of the distribution $\Phi_t(\cdot)$. The first term describes the inflow of new firms with productivity less than z and the second term describes the transition of existing firms into active firms with productivity less than z.

11.   **Market Clearing.** Demand for labor is given by:

$$L^D = w^{-\frac{1-\alpha\gamma}{1-\gamma}}\left[(1-\alpha)\gamma\left(\frac{\alpha}{1-\alpha}\right)^{\alpha\gamma}\right]^{\frac{1}{1-\gamma}}r^{-\frac{\alpha\gamma}{1-\gamma}}M\int_{z,\tau}(1-\tau)^{\frac{1}{1-\gamma}}zg(\tau|z)\phi(z).$$

The aggregate capital stock is also implied by the capital market clearing condition and is equal to:

$$K = w^{-\frac{(1-\alpha)\gamma}{1-\gamma}} \left[\alpha\gamma \left(\frac{1-\alpha}{\alpha} \right)^{(1-\alpha)\gamma} \right]^{\frac{1}{1-\gamma}} r^{-\frac{1-(1-\alpha)\gamma}{1-\gamma}} M \int_{z,\tau} (1-\tau)^{\frac{1}{1-\gamma}} z g(\tau|z)\phi(z).$$

12.   Aggregate Output. Output in the model can be written as:

$$Y = \tilde{A} M^{1-\gamma} (K^\alpha L^{1-\alpha})^\gamma.$$

where total factor productivity $\tilde{A}$ is given by:

$$\tilde{A} = \frac{\int_{z,\tau} (1-\tau)^{\frac{\gamma}{1-\gamma}} z g(\tau|z)\phi(z)}{\left[\int_{z,\tau} (1-\tau)^{\frac{1}{1-\gamma}} z g(\tau|z)\phi(z) \right]^\gamma}.$$

Total factor productivity depends on both the average productivity z of firms operating in the economy and the distribution of factors of production across firms, captured by the joint distribution of (z, τ).

The model nests the model used for growth accounting in that the mass of firms M is proportional to the Cobb-Douglas combination of the aggregate stock of capital and labor.

Model Calibration

13.   To further understand the costs of misallocation, the model is calibrated to match firm-level data from North Macedonia. Annex Table 1 reports the model parameter values and the moments associated with parameters targeted to data.

a.   ***Estimated productivity.*** The productivity process is estimated directly using firm-level data by regressing

$$\ln TFP_{i,t} = \theta \ln TFP_{i,t-1} + \Gamma_t + \varepsilon_{i,t},$$

where Γ_t is a year fixed effect. The estimated coefficient implies an autocorrelation of $\theta = 0.72$. The residual variation in the estimated $\hat{\varepsilon}_{i,t}$ is used to discipline the standard deviation of productivity implying a value of $\sigma_\varepsilon = 0.90$.

b.   ***Estimated distortions.*** *Production barriers are estimated directly by regressing*
$$\ln Wedge_{i,t} = \tilde{\rho} \ln TFP_{i,t} + \Gamma_t + v_{i,t}.$$

c.   ***The estimated coefficient implies an elasticity of the firm-level productivity to the production barrier of*** $\rho = \tilde{\rho} * (1 - \gamma) = 0.57$. *The residual variation in the estimated $\hat{v}_{i,t}$ implies a standard deviation of the production barrier of $\sigma_v = 0.20$*

d.   ***Other parameters calibrated to North Macedonian data.*** *The entry cost ψ, the operation cost f, and the exit rate λ are also calibrated to data.*

Annex Table 1. North Macedonia: Calibrated Model Parameters and Moments

Parameter		Value	Parameter		Value
Population	N	1.0	Exit Rate	λ	0.007
Discount Rate	β	0.9	Entry Cost	ψ	1.0
Elasticity of Substitution	η	3.0	Operation Costs	f	1.3
Capital Share	α	0.4	Autocorrelation of TFP	θ	0.72
Span of Control	γ	0.8	SD of TFP	σ_ε	0.87
Capital Depreciation	δ	0.1	Elasticity of Wedges	ρ	0.118
Labor Preference	χ	1.0	SD of Wedges	σ_v	0.37
Labor Supply Curvature	ζ	1.0			

Annex II. Data Details

1.   **Bureau Van Dijk Orbis Database.** The Orbis dataset is accessed through the Orbis server at the IMF. The construction of data follows Kalemli-Ozcan et al. (2021) with some adjustments. The structural business statistics (SBS) and business demographic (BD) datasets from Eurostat are used to construct firm weights that correct for the firm representation in the population. Firm weights are constructed for firms with employment in the bins: {1–4,5–9,10-19,20–49,50–249,250+}. In constructing firm weights, non-employer firms are removed from the total counts. Average values for the Western Balkan countries are used for country-years in which data is unavailable. All empirical results include firm weights such that the sample is representative of the overall firm size distribution.

2.   **An observation in the dataset is a firm year.** Firms in the financial and utilities sectors are dropped. When necessary, unconsolidated financial reports are used. Firm years for which firms are inactive or where insufficient data to construct final variables are dropped. The final dataset contains over 260,000 firm-year observations from 2012 to 2019, with over 30,000 observations in each year.

3.   **Output is measured as sales subtract material costs when available or alternatively operating revenues subtract material costs.** Capital is measured as the book value of the fixed assets. Employment is measured by the number of employees, or the wage bill divided by the average wage bill per employee. Firm-level TFP is calculated as

$$TFP_{i,t} = \frac{(sales_{i,t} - materials_{i,t})^{\frac{\sigma}{\sigma-1}}}{assets_{i,t}^{\alpha} * employees_{i,t}^{1-\alpha}},$$

and firm-level wedges as

$$Wedge_{i,t} = \frac{sales_{i,t} - materials_{i,t}}{assets_{i,t}^{\alpha} * employees_{i,t}^{1-\alpha}}.$$

For the above expressions, the capital share is set to $\alpha = 0.35$ as in the model calibration and $\sigma = 3$ as in Hsieh and Klenow (2009).

4.   **In the main analysis, TFP and Wedge are regressed on sector-by-year fixed effects to remove temporal and sectoral variation.**

5.   **Eurostat.** Two databases from Eurostat are used in the analysis. These are outlined below.

- *Structural Business Statistics (SBS)*. The dataset contains information on the number of firms by size bin, divided into 0-9 employees, 10–19 employees, 20–49 employees, 50–249 employees, and 250 plus employees. These categories are used to construct firm weights used in the empirical analysis.

- *Business Demography* (BD). The dataset contains information on the number of firms, employment by firms, and entry and exit of firms by size bins. The size bins contain more

granularity for small business (less than 10 employees) compared with the SBS dataset. The BD dataset contains the count of non-employer firms, which are removed from the total firm count when constructing firm weights. The exit rates by firm size bin are used in the calibration of the model.

6.   Penn World Tables v10.0. The Penn World Table database is used to construct country-year measures of total factor productivity (TFP), output, population, and capital.
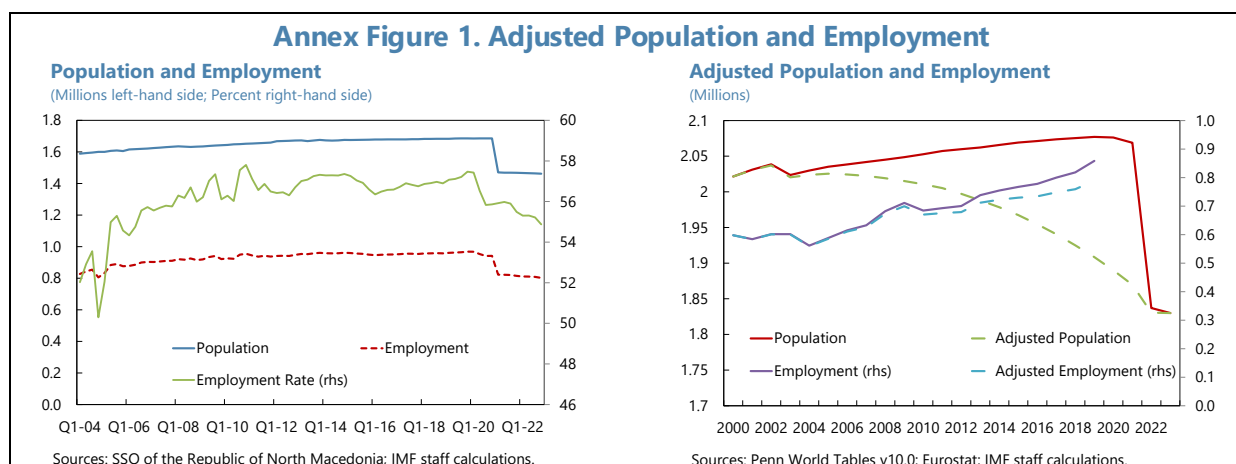
Annex III. Labor and Population Adjustments

1. **North Macedonia conducted population censuses in 2002 and in 2021.** The 2021 census led to a large revision in the total population and labor force relative to the extrapolated values based on the 2002 census, highlighted in Annex Figure 1, left panel. Despite these adjustments, the employment ratio remained relatively stable over this period. A concern with the growth account exercise in the main text is that the true population and employment level was much lower in 2019 than is recorded in the Penn World Tables.

2. **Without more data, it is difficult to ascertain the extent that the population and employment series differ from the data over the 2000 to 2019 period.** That said, the updated population data can be used to try to put boundaries on the sensitivity of the baseline results to this adjustment. To this end, staff construct adjusted population and employment series. The adjusted series assume that the recorded values are correct in 2002 and 2021, the years of the census. The adjusted series is interpolated in the intermediary periods as

$$Adjusted\ Population_t = \left(1 - \left(\frac{t-2002}{19}\right)^{\xi}\right) * Population_t + \left(\frac{t-2002}{19}\right)^{\xi} * Population_{2021}$$

where $Population_t$ is the recorded population series and ξ is a parameter that controls for the rate that the recorded population series deviated from the true population. Higher values of ξ indicate that more weight is put placed on the recorded population series. The value of ξ is set to 2. The same adjustment factor is used for the employment series, such that the employment rate is equal to the recorded value. The recorded and adjusted series are reported in Annex Figure 1, right panel.

Annex Figure 1. Adjusted Population and Employment

Sources: SSO of the Republic of North Macedonia; IMF staff calculations.

Sources: Penn World Tables v10.0; Eurostat; IMF staff calculations.

3. **The adjusted population and employment series are both below the recorded series over the 2000 to 2019 period.** Annex Table 2 compares the growth accounting exercise using both the recorded and adjusted data series. Output-per-capita growth is around 0.4 percentage points higher than in the baseline exercise since the denominator (population) shrinks over this period. This additional growth is fully absorbed by the residual component, total factor productivity, because labor participation is assumed to follow the baseline. The main conclusions of the growth accounting exercise are more-or-less unchanged.

Annex Table 1. North Macedonia: Growth Accounting with Adjusted Population and Employment

	Benchmark		Adjusted	
	Growth	**Contribution (%)**	**Growth**	**Contribution (%)**
Output-per-Capita	3.67	100	4.07	100
Capital / Output	0.66	9.7	0.66	8.7
Labor Participation	1.69	46.1	1.67	41.1
Total Factor Productivity	1.05	44.2	1.32	50.2

Sources: Penn World Tables v10.0; Eurostat; IMF staff calculations.

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