



# BULGARIA

## SELECTED ISSUES

June 2024

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# BULGARIA

## SELECTED ISSUES

May 10, 2024

Approved By  
European Department

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# THE BULGARIAN PENSION SYSTEM: CAUGHT BETWEEN ADEQUACY AND SUSTAINABILITY<sup>1</sup>

*During the COVID-19 pandemic, the Bulgarian authorities increased pensions substantially to support pensioners' living standards and aggregate demand. These increases have become permanent and improved the adequacy of pensions. However, not matched by revenue measures, they have widened the deficit of the pension system. Reforms that increase the incentives to contribute to the pension system and thus revenue would improve the financial sustainability of the pension system and reduce fiscal risks.*

**1. The COVID-19 measures related to pensions structurally increase spending.** During the pandemic, increasing pensions was one of the tools deployed by the Bulgarian authorities to support demand. Some of the measures were announced to be temporary but were made permanent in 2022. As offsetting revenue measures were limited, the deficit of the pension system increased. This presents a fiscal burden given the legal requirement for the state to transfer funds to cover the pension system deficits.

**2. As adequacy remains an issue, reforms should aim at increasing contributions.** The recent measures increased the adequacy of pensions, but pensions remain low compared to wages, and pensioners poverty remains widespread. Thus, there is little scope for reducing the generosity of pensions. This paper argues that, instead, reforms should focus on increasing incentives to contribute which, in turn, will increase revenue.

**3. This paper is organized as follows.** The first section provides an overview of the pension system and describes measures taken in the last decade to increase its financial sustainability. The second section highlights how the measures taken during and after the COVID-19 pandemic structurally affect the financial sustainability of the pension system. The third section shows that the recent measures compound the long-term pressure related to an aging population. The fourth section details policies that could contain the projected increase in pension spending.

## A. An Overview of the Pension System and of Past Policies to Ensure Financial Sustainability

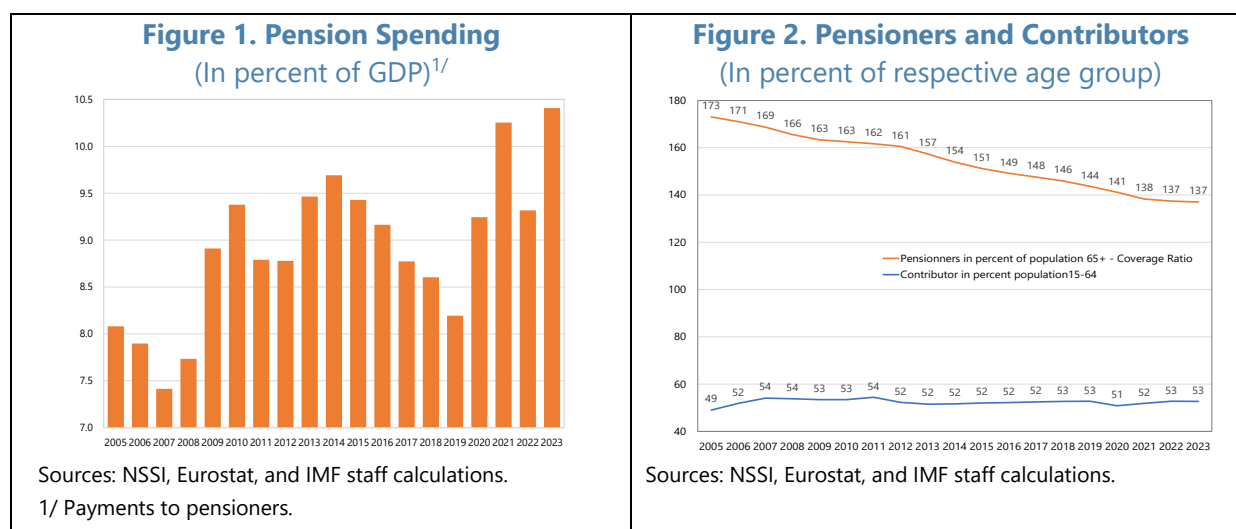
**4. The Bulgarian pension system is organized around three pillars.** The first pillar is a mandatory, defined benefit, pay-as-you-go system administrated by the National Social Security Institute (NSSI). It provides old age and survivor pensions as well as disability pensions due to sickness, accident, and occupational disease. It is financed by a contribution rate (employer and employees) of 14.8 percent of the gross insurable income for individuals born after 1959 and

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<sup>1</sup> Prepared by Jean-Jacques Hallaert (EUR). The author thanks Jean-François Dauphin and Helge Berger for useful comments, Igljika Vassileva for her comments and unvaluable help with data and information gathering, and staff and officials from the National Social Security Institute, the Ministry of Finance, and participants at a seminar at the Ministry of Finance for useful discussions.

19.8 percent for individuals born in 1959 or before.<sup>2</sup> The second pillar is a defined contribution system managed by licensed private pension providers. It is mandatory for individuals born after 1959 and funded by a contribution rate of 5 percent. The third pillar is a voluntary defined contribution system managed by licensed private pension providers (Republic of Bulgaria, 2020).

**5. In the 2010s, measures were taken to ensure the financial sustainability of the pension system.** Early in the 2010s, a pension freeze was implemented. This reduced the pension-to-GDP ratio, temporarily and partially offsetting the increase during the Global Financial Crisis (GFC).<sup>3</sup> It was followed in 2015 by a reform (implemented starting in 2016). The 2015 reform had a more lasting impact reducing pension spending by 1½ percent of GDP between 2014 and 2019 (Figure 1).



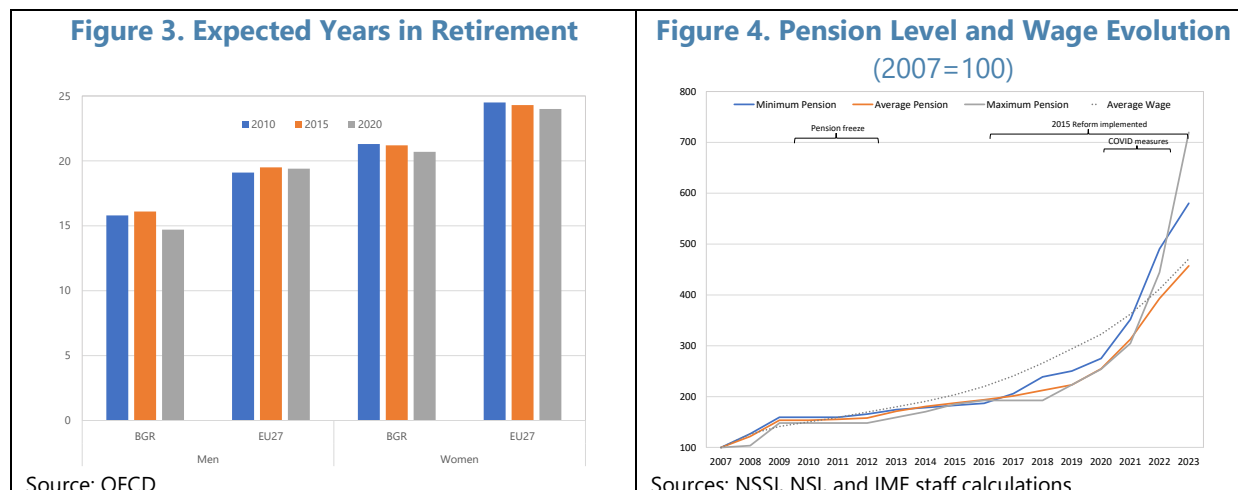
**6. The 2015 reform increased the financial sustainability by curtailing access to pensions.** The reform gradually increases the retirement age (from 63 and 8 months for men and 60 and 8 months for women to 65 in 2029 for men and in 2037 for women) and the required minimum contribution period (by two months every year until it reaches 40 years for men and 37 years for women by 2027).<sup>4</sup> Following its implementation, the coverage ratio continued to decline (Figure 2), and the 2021 Ageing Report (EC, 2021) projects that it would continue to do so in the coming decades and be below EU average by 2040.<sup>5</sup> The expected years in retirement also declined. This decline was more rapid than for the EU as a whole (Figure 3).

<sup>2</sup> Self-employed contribute themselves to the at the same rate of 14.8/19.8 percent. The rate is applied to the declared covered earnings for the previous calendar year (Republic of Bulgaria, 2020; Eurostat (2022)).

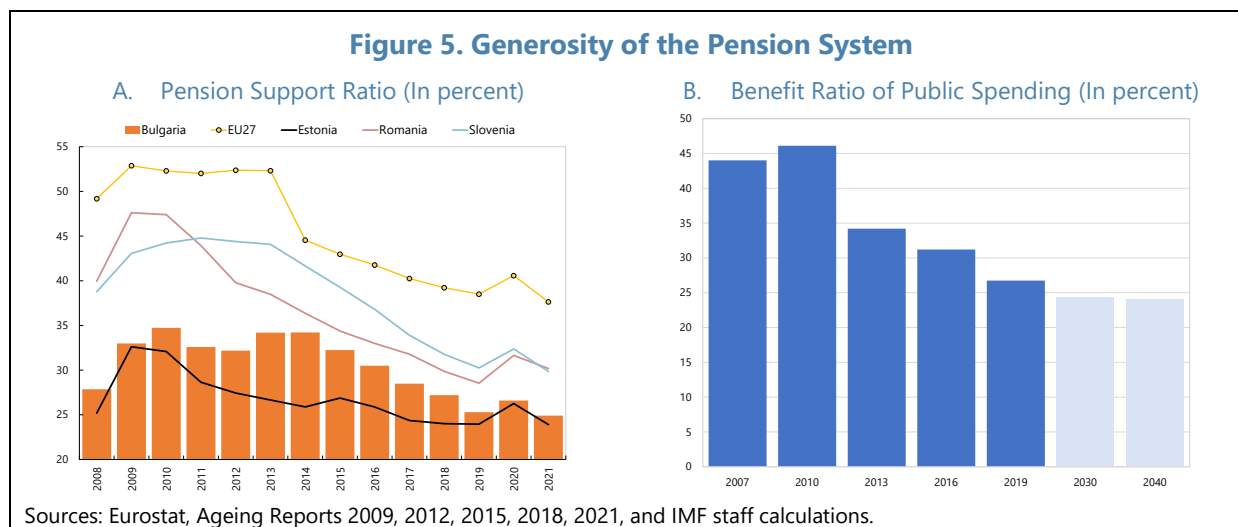
<sup>3</sup> See Republic of Bulgaria (2020), Hallaert (2020), and Eurostat (2022) for a description of the indexation mechanism.

<sup>4</sup> For details, see Republic of Bulgaria (2020) and Eurostat (2022).

<sup>5</sup> The coverage ratio is the number of pensioners as a share of population 65 and older.

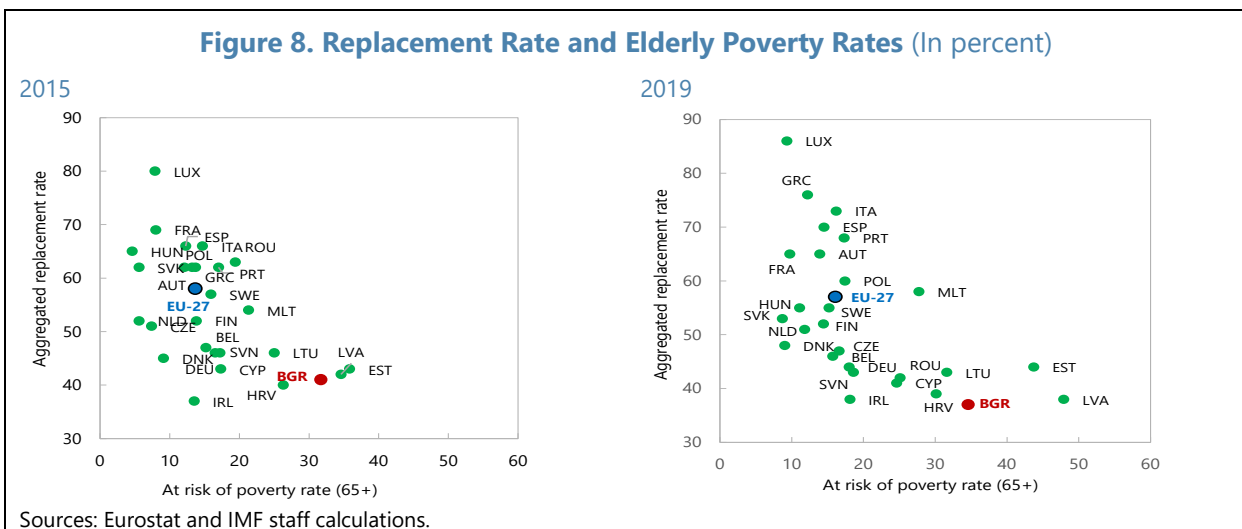
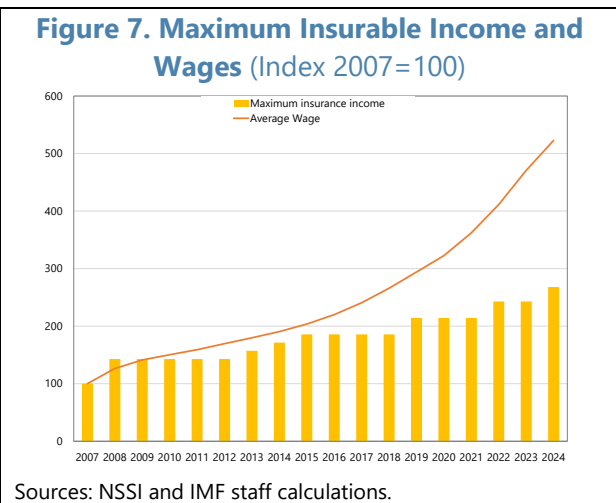
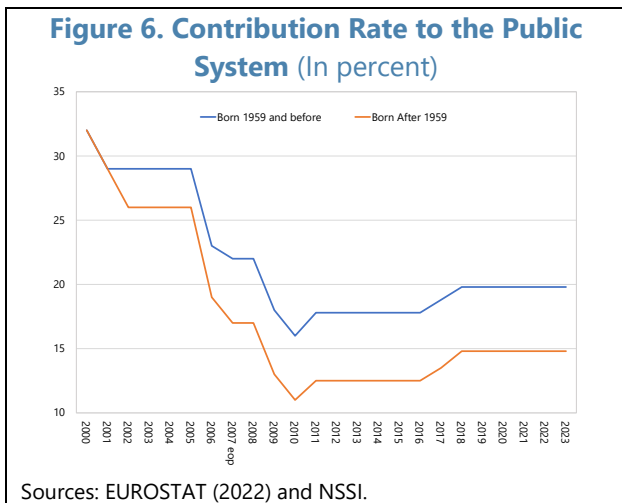


**7. The generosity of pensions was also reduced.** The generosity of the pension system can be measured by the support ratio defined as pension benefit per person over 65 divided by GDP per person of working age (Lindert, 2021). This ratio declined markedly after the reform, in line with declines observed in European peers. Although the reform increased marginally the gross replacement rate, the benefit ratio continued to decline markedly as increases in pensions lagged wage growth (Figures 4 and 5).<sup>6</sup>



**8. In contrast, revenue measures were limited.** The 2015 reform increased the contribution rate partially offsetting the decline in previous years (Figure 6). However, the cap on social contributions (the maximum insurable income) remained unchanged in nominal terms from 2015 to 2019, while wage growth was robust (Figure 7). This negatively affected revenue and resulted in a lower average effective contribution rate for high wage earners.

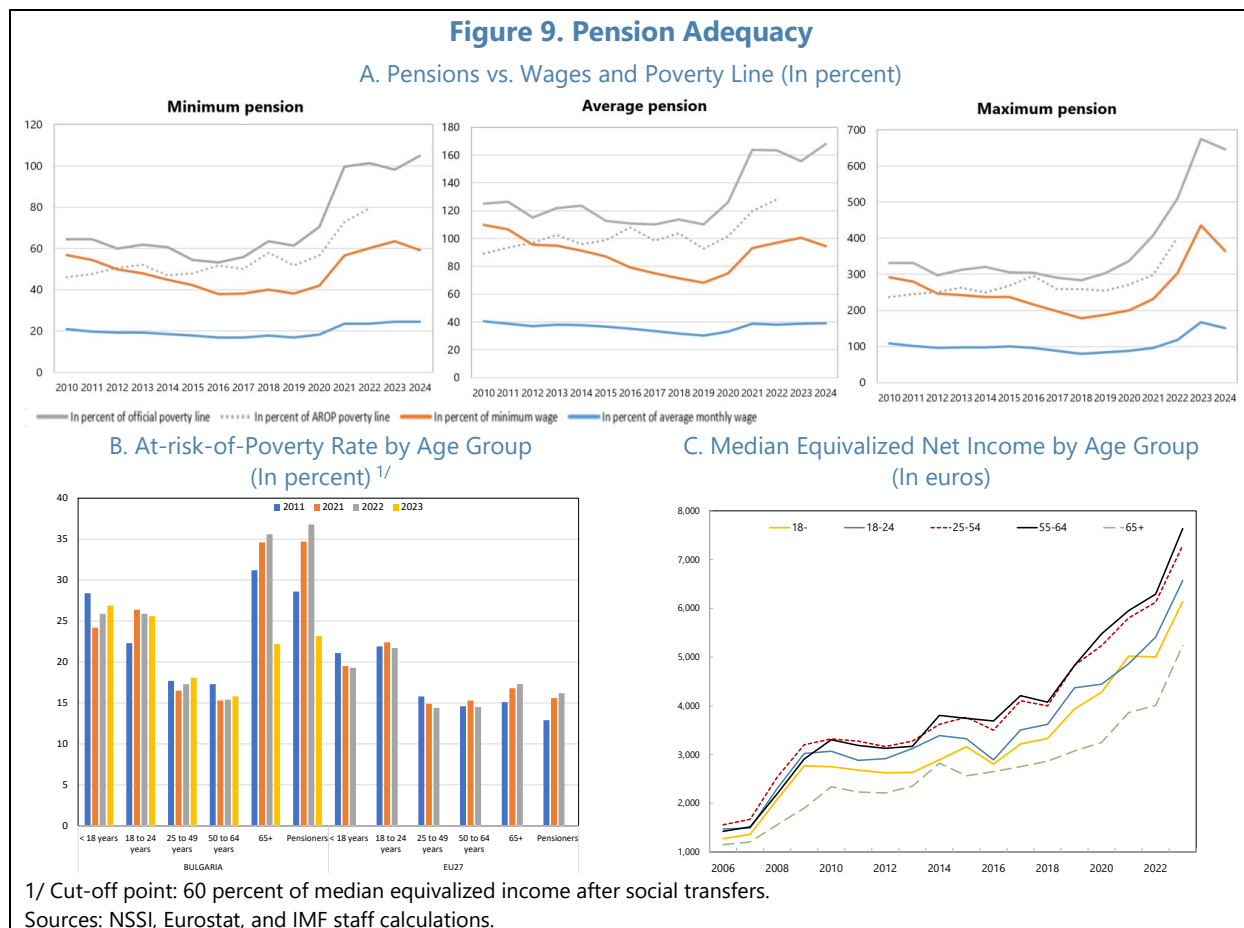
<sup>6</sup> The gross replacement rate is the average first pension as a share of the economy-wide average wage at retirement. The benefit ratio is the average pension as a share of average compensation.



**9. Buttressing the financial sustainability of the pension system was achieved at the cost of reduced pensions adequacy.** After the 2015 reform, the already low replacement rate declined (Figure 8). The share of pensioners receiving the minimum pension, which had declined in the first half of the 2010s, increased from 27 percent in 2016 to 35 percent in 2019.<sup>7</sup> In the meantime, the minimum pension dropped from 57 percent of the minimum wage in 2010 to 38 percent in 2019 and remained well below the poverty line. In this context, many pensioners continue to work to supplement their pension. This reduces the impact of low pensions on old-age poverty but did not prevent the disposable income of the elderly from being significantly lower than the income of other age groups. Thus, unlike in the EU as a whole, the elderly (65 and older) was until 2022 the age group suffering the most from poverty and the poverty rate of elderly and pensioners increased markedly in the last decade (Figure 9).

<sup>7</sup> The share reached 46 percent in 2022 and 2023.



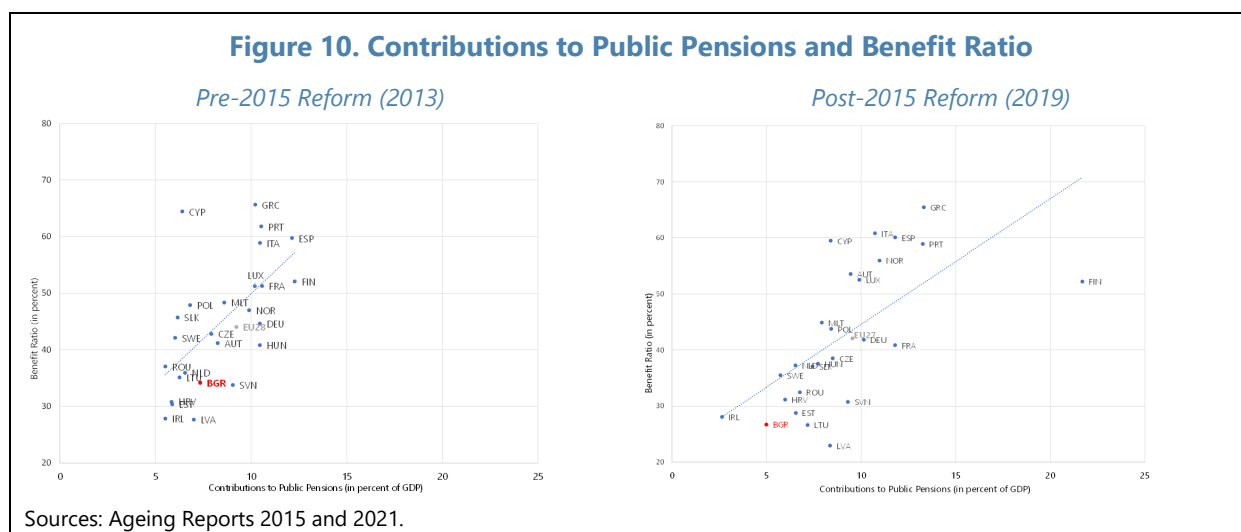


**10. As a low contribution - low benefit system, the Bulgarian pension system results in relatively limited spending.** The 2015 reform reinforced this logic, and Bulgaria's spending on pensions was, on the eve of the pandemic, more than 5 percent of GDP lower than EU average (Figure 10).

## B. The COVID-19 Pandemic Measures: A Game Changer that Increased Imbalances

**11. Pensions were a significant part of the fiscal package deployed during the pandemic.** More than half of the fiscal support provided to households in 2020–21 targeted pensioners. This accounted for over 1 percent of GDP in 2021 (Table 1). The support mainly took the form of pensions increases and ad-hoc supplementary payments (bonuses) (Table 2). Support measures were planned to be phased out in 2022, but a revised budget for that year increased pensions more than initially budgeted, incorporated permanently in pensions the bonuses that were initially introduced as a temporary response to the pandemic, and modified pension calculations. This significantly increased the generosity of the system (IMF, 2022; NSSI, 2022a and b) and the

adequacy of pensions. In 2023, when the full impact of the measure is visible, old-age poverty dropped markedly but pension spending rebounded strongly (Figures 1 and 9).<sup>8,9</sup>



**12. The marked increase in pension spending was not matched by commensurate revenue increases.** The contribution rate and the maximum insurable income were left unchanged during the pandemic (Figures 6 and 7). As wage growth remained robust, the share of contributors benefiting from the cap on social contributions increased from 6.4 percent in 2019 to 14.2 percent in 2023 and the contributions at maximum social insurable income represent over 21 percent of total contributions (up from 13.6 percent in 2019). Moreover, the increase in the maximum pension has become disconnected from the maximum insurable income: over 2009–19, the maximum pension was set at 35 percent of the maximum insurable income, but the ratio increased to 40 percent in 2020, 48 percent in 2021, 62 percent in 2022, and 100 percent in 2023 and the increase in 2024 will bring this ratio to only 91 percent. Due to such a rapid increase, the share of pensioners receiving the maximum pension fell from 2 percent in 2020 to 0.1 percent in 2023 (Table 3). In other terms, contributions are increasingly capped affecting the system revenue, while the cap on pensions has *de facto* disappeared and thus does not contain spending anymore.

**Table 1. Bulgaria: COVID-Related Fiscal Measures<sup>1</sup> (In percent)**

	2020		2021	
	Distribution		Share of GDP	
Household support	30	49	0.9	2.3
o/w pensions	14	28	0.5	1.3
Corporate support	7	9	0.2	0.4
Job retention scheme	26	14	0.8	0.7
Health	18	26	0.6	1.3
Capital increase of BDB 2/	18	-	0.6	-
Co-financing of EU program	0	2	0.0	0.1
<b>Total</b>	<b>100</b>	<b>100</b>	<b>3.2</b>	<b>4.8</b>

Sources: Bulgarian Ministry of Finance and IMF staff calculations.  
 1/ Financed by the national budget.  
 2/ The Bulgarian Development Bank (BDB) is a state-owned bank. The capital increase was to finance the issuance of guarantees to commercial banks for the extension of corporate and for providing interest-free loans to employees on unpaid leave.

<sup>8</sup> In addition, in 2023, the widow's allowances increased from 26.5 percent to 30 percent of the deceased spouse's pension. The NSSI estimates that it increases pension payment by 0.7 percent in 2023.

<sup>9</sup> For more details on the changes in the pension system during the pandemic, see NSI (2022).

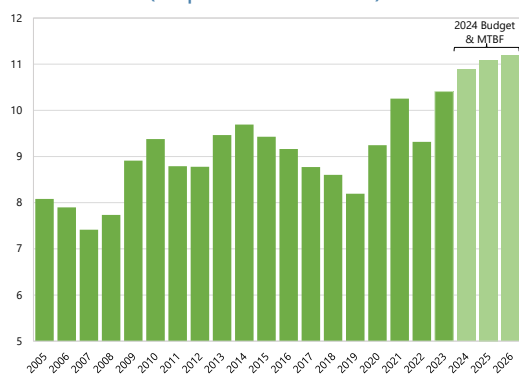
**Table 2. Bulgaria: Pension and Increases** (In percent, end of period)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Minimum pension 1/	without bonus 2/	0	0	6.6	3.4	3.0	1.9	2.5	23.9	3.8	5.7	13.9	48.0
	with bonus 2/											36.7	63.3
Average pension	without bonus 2/	1.3	2.2	0.7	18.3	3.3	4.0	2.4	5.9	3.8	7.3	14.6	25.2
	with bonus 2/											26.5	36.0
Maximum pension	without bonus 2/	0	0	0	10.0	9.1	8.3	0	0	0	31.9	0	25.0
	with bonus 2/											4.2	29.6

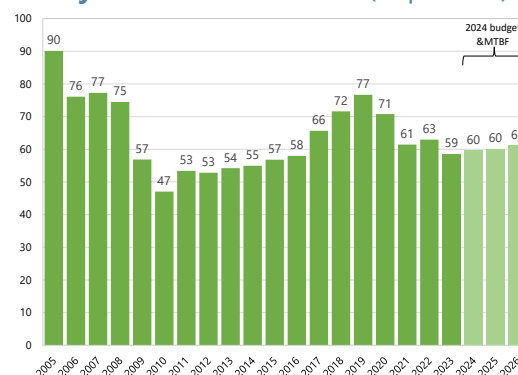
Source: IMF (2022).

1/ For 2021: the minimum old-age pension was set at BGN 300 up to December 24 (20 percent increase compared to end 2020) and BGN 370 from 25 to 31 December (48 percent increase compared to end 2020).

2/ Lump sum pension supplement for all pensioners amounting to BGN 50 from August 2020 to September 2021 and to BGN 120 from October to December 2021.

**Figure 11. Payments to Pensioners**  
(In percent of GDP)

Sources: NSSI and IMF staff calculations.

**Figure 12. Social Contributions in Share of Payments to Pensioners**  
(In percent)

Sources: NSSI and IMF staff calculations.

**13. The COVID-19 measures have affected the financial sustainability of the pension system.** Pension spending reached a historical high in 2023, and the medium-term budget framework (MTBF) expects it to continue rising in the coming years (Figure 11).<sup>10</sup> While the pension freeze and the 2015 reform had gradually increased the share of pension payments financed by social contributions, the share fell back to its 2015 level in 2023 and the MTBF expects only a limited recovery in the coming years (Figure 12).

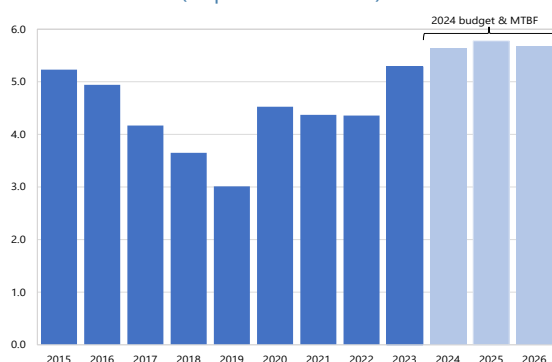
<sup>10</sup> The 2024 financial data do not include the impact of the Easter supplement voted by Parliament in April 2024. The supplement of BGN 100 granted to pensioners whose pension is below the official poverty line of BGN 526 per month has an estimated cost of 0.03 percent of GDP.

**Table 3. Bulgaria: Maximum Insurable Income and Maximum Pension (In percent)**

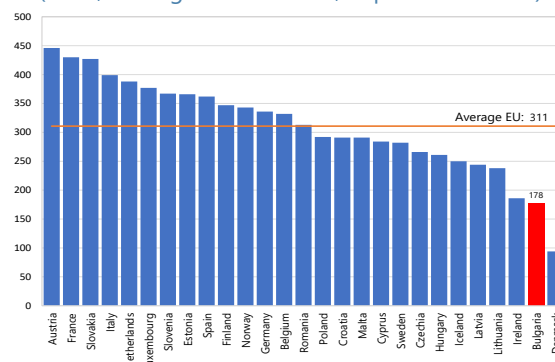
	2019	2020	2021	2022	2023	2024 Proj.
Maximum pension as a share of						
Payments to pensioners	5.7	4.6	2.6	2.5	0.3	0.4
Numbers of pensioners	1.3	2.0	1.3	0.0	0.1	0.1
Contributions at maximum insurable income as a share of						
Total contributions	13.6	15.2	17.8	18.2	21.1	21.2
Number of contributors	6.4	8.4	10.9	11.1	14.2	14.2

Sources: NSSI and IMF staff calculations.

**14. The rising deficit of the pension system constitutes a fiscal burden.** In Bulgaria, the pension system deficit is by law financed by transfers from the state. Therefore, the pension system is not indebted, but its deficits could lead to higher general government debt absent other offsetting measures. The system has been structurally in deficit, but the 2015 reform helped gradually improve its fiscal balance. With the pandemic measures, the transfers from the state to cover the deficit rebounded to their pre-2015 reform. They increased by 2.3 percentage points of GDP between 2019 and 2023 and are expected to further increase in the coming years (Figure 13). Such an increase in transfers weighs on the general government's fiscal balance and may crowd out other more productive spendings and/or increase (the currently low) public debt.

**Figure 13. Fiscal Transfers to Cover the Deficits (In percent of GDP)**

Source: NSSI.

**Figure 14. Pension Entitlements in Social Insurance (2018, closing balance sheet, in percent of GDP)**

Source: Eurostat.

## C. Long-Term Demographic Pressures

**15. Low contingent liabilities mitigate fiscal risks in the medium-term.** In part due to low level of benefits, the present value of pensions to be paid in the future based on accrued rights are among the lowest in Europe (Figure 14).<sup>11</sup> Moreover, they only marginally increased from

<sup>11</sup> See Eurostat (2016 and 2021) for details on the concepts and measurement for Bulgaria.

168 percent of GDP in 2015 to 186 percent of GDP in 2016 before declining to 178 percent in 2018. The accrued pension rights are overwhelmingly related to the pay-as-you-go system as the share of the private pension schemes in accounted for less than 7 percent of accumulated entitlements in 2018.

### Box 1. Various Population Projections

**EUROPOP 2019.** Population projections (size and structure) done in 2019 for the period 2019–2100 for all EU Members, Iceland, Liechtenstein, Norway, and Switzerland. These projections underpin the 2021 Ageing Report, which covers the period 2019–70 (EC, 2021). Data, metadata, and methodology are available on the [Eurostat website](#).

**EUROPOP 2023.** Population projections (size and structure) done in 2023 for the period 2022–2100 for all EU Members, Iceland, Norway, and Switzerland. These projections will underpin the forthcoming 2024 Ageing Report. Data and methodology are available on the [Eurostat website](#).

**NSI.** In 2023, the National Statistical Institute recalculated population estimates based on the 2001 and 2011 census results, as well as on data on natural and migration increase during the respective period. In November 2023, it updated population projections until 2090. Revised projections are available on the [National statistical institute website](#).

**16. However, the pension system will be under pressure in the coming decades due to aging.** Since 2005, the Bulgarian population has been shrinking due to a sharp decline in population below 65. However, the population at retirement age (65 and older) increased. Available demographic projections concur that the population will continue to shrink and continue to age, although the pace of aging is uncertain as highlighted by differences between EuroPOP projections and the NSI projections (Box 1 and Table 4).<sup>12</sup>

**Table 4. Bulgaria: Population Growth by Age Group**  
(Annual average in percent)

	2005-2022	2022-70 (projection)		
		EuroPOP 2019	EuroPOP 2023	NSI
Total	-0.7	-0.6	-0.5	-0.6
<65	-1.0	-0.9	-0.8	-0.7
65+	0.6	0.3	0.2	-0.3

Sources: Eurostat, NSI, and IMF staff calculations.

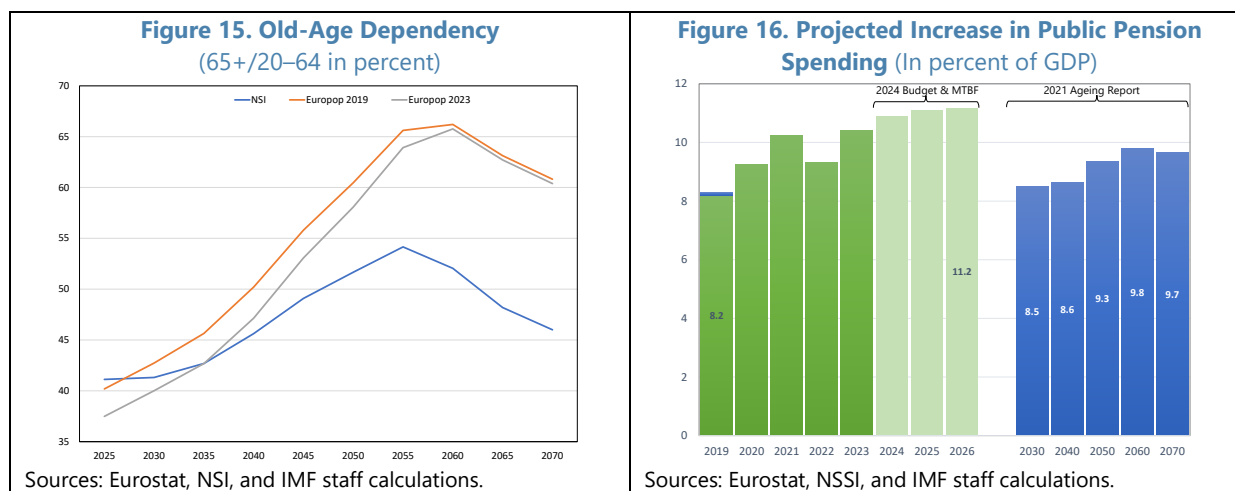
**17. Old-age dependency is projected to increase markedly.** Although different in magnitude, EuroPOP and national projections foresee an increase in old-age dependency in the coming three decades before declining (Figure 15). Such an increase will have a strong impact on pension costs. Indeed, the 2021 Ageing Report shows that old-age dependency will be the main driver in the projected increase in the public-pension-to-GDP ratio in the long run (EC, 2021).

**18. The 2021 Ageing Report's projected increase in pension spending appears underestimated considering recent developments.** The Ageing Report projections were finalized before the recent pension measures were taken.<sup>13</sup> Although the actual spending for 2019 (the base

<sup>12</sup> The main difference is due to the fact that, unlike EUROPOP, the NSI projections incorporate the results of the latest census.

<sup>13</sup> The projections were made using the pension legislation in place at end-2020 (EC, 2021).

year) was slightly overestimated in the Ageing Report, actual spending already exceeds the projected peak (Figure 16). As the revised Europop projections that will underpin the 2024 Ageing Report do not suggest substantial demographic changes (Table 4 and Figure 15), the projections of the 2021 Ageing Report now appear to significantly underestimate pension spending in the coming decades. Nonetheless they provide a sense of the long-term dynamic of spending pressure (Figure 16).



## D. How to Mitigate the Projected Increase in Pension Burden?

**19. Although pensions are low, they are generous compared to contributions.** The sustainability and actuarial fairness of a pay-as-you-go system without debt implies that the proportionality measure (PM), defined as:

$$PM = \text{Present Value of Benefits} / \text{Present Value of Contributions}$$

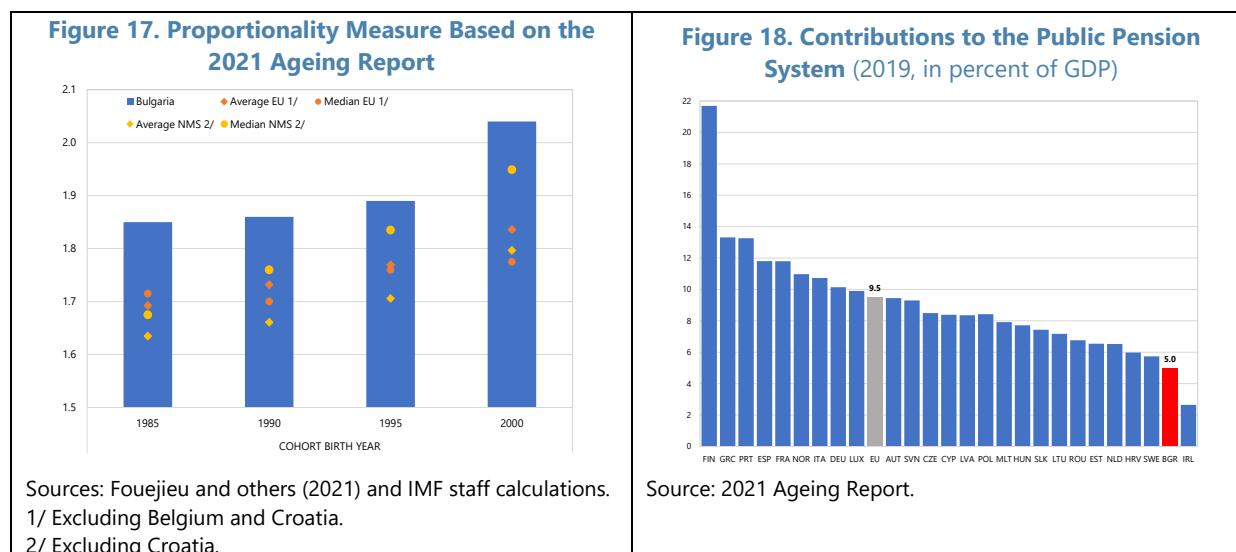
is equal to 1 (Fouejieu and others, 2021). The PM in Bulgaria is significantly above this level (Figure 17). It is higher for younger cohorts than for older cohorts and higher than for the EU or Newer Member States peers (NMS).<sup>14,15</sup> In simple terms, a person born in 2000 can expect a pension that is low but is about twice larger than his/her contribution (Figure 17).<sup>16,17</sup> Closing the gap between present value of pensions and present value of contributions and increasing the share of pension payments financed by contributions (Figure 12) could be achieved either by a reduction of pension generosity or by revenue increasing measures.

<sup>14</sup> The PM for younger cohorts better reflects the steady state.

<sup>15</sup> Newer Member States are Bulgaria, Croatia, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovakia, and Slovenia.

<sup>16</sup> The calculation is based on the 2021 Ageing Report and thus does not take changes taken since end-2020 (EC, 2021), which are likely to have increase the gap between pension and contributions.

<sup>17</sup> A calculation is based on the 2018 Ageing Report would imply a larger gap between contribution and pensions. The reduction reflects in part the impact of the 2015 reform.



**20. Continuing with past practice of reducing the generosity of pensions to restore financial sustainability is not advisable.** Further reducing pensions adequacy is undesirable socially and unlikely to be politically sustainable considering demographic pressures and widespread old-age poverty. Moreover, as the experience with pandemic shows, the desire to support demand in time of crisis may lead to an increase in pensions that would be difficult to reverse and could quickly jeopardize the financial sustainability of the pension system. Finally, further reducing pension adequacy would increase incentives for contribution avoidance. This would erode the fiscal impact of reduced pension generosity and, more generally, reduce fiscal revenue from social contributions and personal income taxes (PIT).

**21. Instead, policies should focus on increasing incentives to contribute to the pension system.** The current old-age benefit formula is:

$$B = AII \times IC \times IP \times AR$$

Where:

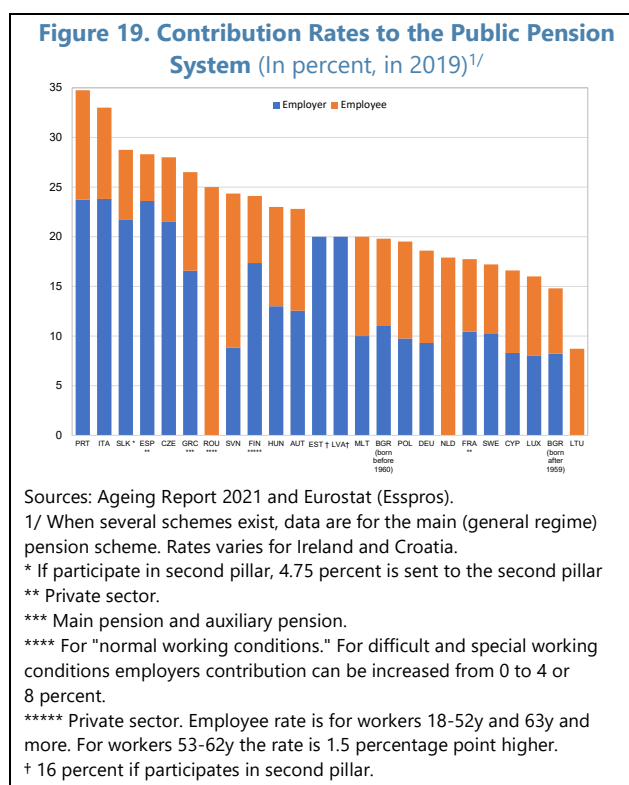
- B is the pension benefit,
- AII is the national monthly average insurable income for 12 months preceding retirement,
- IC is the ratio between the average insurable income of the person and the average insurable income for the country in the periods of insurance,<sup>18</sup>

<sup>18</sup> Average of the monthly ratios calculated after 1999.

- IP is the insurance period (contributory and non-contributory periods), and
- AR is the accrual rate.<sup>19,20</sup>

Because benefits are based on the length of the contribution period and insurable income rather than on contributions actually paid, the formula provides individuals little incentives to contribute to the pension system.<sup>21</sup> The disincentive to contribute is reinforced by the fact that a retiree will receive the minimum pension even if the calculated pension is lower than the minimum pension. Therefore, the current system encourages the widespread underreporting of wages and informal work.<sup>22</sup> This partly explains why the contributions-to-GDP ratio is low by EU standards (Figure 18), and why only about half of the working age population contributes to the (mandatory) pension system (Figure 2), while the employment rate of working age population slightly exceeds 70 percent.

**22. Increasing the perception that contributions are a valuable saving would improve the sustainability and the fairness of the pension system.** Revising the benefit formula to incorporate contributions actually paid would increase incentives to contribute and result in increased revenue for the pension system as well as for the national budget (increased revenue from PIT due to better reporting of wages). As the financial situation of the pension system would be strengthened, the need for fiscal transfers would be reduced creating fiscal space for more productive spending. Moreover, as the incentives to contribute are reinforced, it will be possible to increase the contribution rate (which is among the lowest in the EU - Figure 19) and to eliminate the cap on social contributions (maximum insurable income) in combination with the elimination of maximum pension. This



<sup>19</sup> The accrual rate is the weight of one year of service.

<sup>20</sup> For details on the calculation of other types of pensions and on the acquisition of pension rights, see Eurostat (20212) and Republic of Bulgaria (2020).

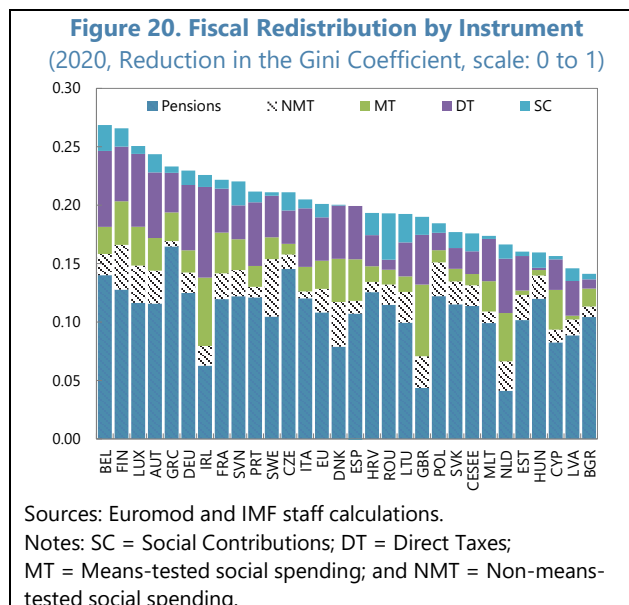
<sup>21</sup> Through transfers, the state covers all non-contributory pension benefits and some non-contributory periods considered as insurance period. (Republic of Bulgaria, 2020).

<sup>22</sup> The underreporting of wages and the cap on social contributions (maximum insurable income) in turn affect the level of pensions (through the "All" and "IC" components of the formula). This contributes to the large share of pensioners receiving minimum pension (46 percent of pensioners in 2023). As minimum pensions are low, this further undermines the perception that contributions to the pension system constitute a valuable saving and thus undermines willingness to contribute.



would lead to further increase the pension system revenue as over 21 percent of contributions are now capped (benefiting 14 percent of contributors) , while the maximum pensions account for less than 0.5 percent of pension payments (and 0.1 percent of pensioners - Table 3).

The elimination of the maximum pension would also further increase incentives to contribute while the elimination of the maximum insurable income. Finally, these measures would also further increase both the pension system revenue and the currently limited role of social contributions in reducing the high- and rising-income inequality (Hallaert, 2020; Figure 20). In the meantime (as the reform of the pension formula may take time), the maximum social insurance income should be linked to wage growth. This would revert the recent and sharp increase in the share of contributors benefiting from the cap on contribution and increase revenue.<sup>23</sup>



## E. Conclusion

**23. Pension spending increased markedly in recent years.** Increasing pensions was one of the key tools deployed by the Bulgarian authorities to support households during the COVID-19 pandemic. Those increases became permanent and, together with additional measures, allowed to improve the adequacy of pensions.

**24. However, not matched by sufficient revenue measures, the additional spending presents fiscal risks.** The fiscal transfers required to cover the pension system deficit have jumped to over 5½ percent of GDP and are expected to remain at this level in the coming years. As a result, pension deficits risk crowding out more productive spending needed to boost productivity and income convergence with other European countries. Moreover, the pension system deficit is likely to increase in the medium term due to pressures from the aging of the population.

**25. In the last decade, financial sustainability of the pension system was buttressed by a reduction in the generosity of pensions.** The pension freeze in the early 2010s followed by the 2015 reform cut pension benefits to reduce pension system deficits. Revenue measures were largely marginal. As a result, the Bulgarian pension system is increasingly a system of low contribution and low benefit.

<sup>23</sup> From a general government fiscal perspective, the revenue of an increase in the maximum insurable income would be partly eroded by an increase in spending programs linked to its level, which may improve social protection coverage (Hallaert, 2020) and further increase fiscal redistribution.

**26. Such an approach does not appear feasible anymore.** The adequacy of pension is low. Pensions are often below minimum wage and the poverty line forcing many elderly to continue working. Old-age and pensioners' poverty remain high compared to both the EU level and other age groups.

**27. Instead restoring the pension system fiscal sustainability would require a change in the pension formula to increase revenue and incentivize contributing.** At the individual level, the pension benefit formula provides little incentives to contribute, encouraging informal work and underreporting of wages. Revenue from social contribution payments and personal income tax revenue are negatively affected. Moreover, a cap on social contributions that lag wage increases erodes the tax base and results in a regressive social contribution system and lower fiscal redistribution in a country facing high- and rising-income inequality. Increasing the link between pension benefits and paid contributions therefore appears warranted. It would increase the incentive to contribute helping to bring pensions closer to a sustainable and actuarial fair level without reducing them.

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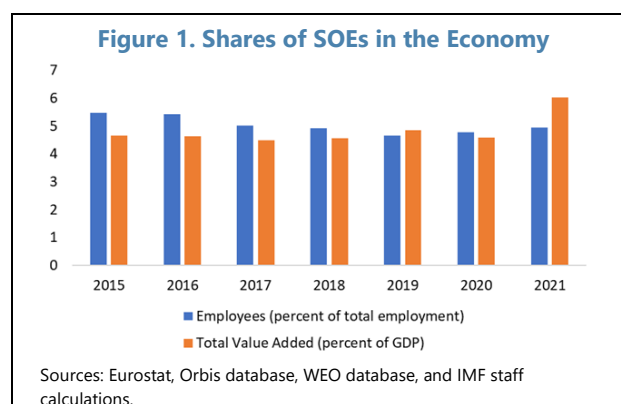
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# BULGARIA: FISCAL RISKS FROM STATE-OWNED ENTERPRISES<sup>1</sup>

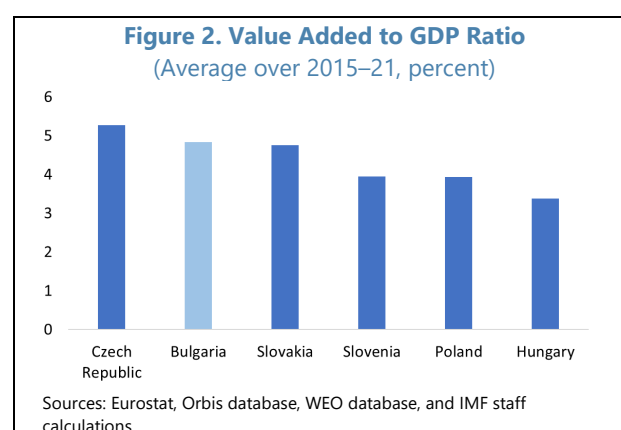
*State-owned enterprises' (SOEs) economic and financial performance may have important fiscal implications. This study evaluates related fiscal risks in Bulgaria from both aggregate and firm-level perspectives. The low level of state-guaranteed debt of SOEs poses minimal fiscal risk. However, contingent liabilities could be a fiscal concern in the long term due to the low profitability of major SOEs and their inefficient resource allocation. Given their crucial role in the production network, their inefficiencies likely negatively impact the overall economy's productivity and competitiveness. Additionally, liquidity and solvency risks are evident in several key SOEs. These findings underscore the need for monitoring and improving SOEs' financial performance.*

## A. Introduction

**1. State-owned enterprises play an important role in Bulgaria's economy.** There are about 700 SOEs, i.e., firms in which the central government or sub-national government levels own a minimum stake of 50.1 percent.<sup>2</sup> They are especially important in network industries, such as energy and transportation. In total, SOEs' value added is about 5 percent of GDP, greater than in some other EU newer member states, including Hungary and Poland (Figures 1 and 2). SOEs account for about 4.1 percent of total employment (Figure 1).



**2. The financial soundness of SOEs may impact fiscal outcomes through different channels.** Taxes, royalties, and dividends received from SOEs contribute to overall government revenue. Governments may face potentially substantial costs when SOEs struggle to service their debt, in case of explicit loan guarantees. In many cases, SOEs-related fiscal risks are implicit and can weigh on public finances even in the absence of a contractual obligation. For instance, the government may



<sup>1</sup> Prepared by Anh Dinh Minh Nguyen (FAD). The author thanks Jean-François Dauphin, Jean-Jacques Hallaert, Iglia Vassileva, and Giacomo Magistretti for their useful comments and suggestions, and the staff of Bulgaria's Ministry of Finance, Public Enterprises and Control Agency, and National Bank of Bulgaria for useful discussions.

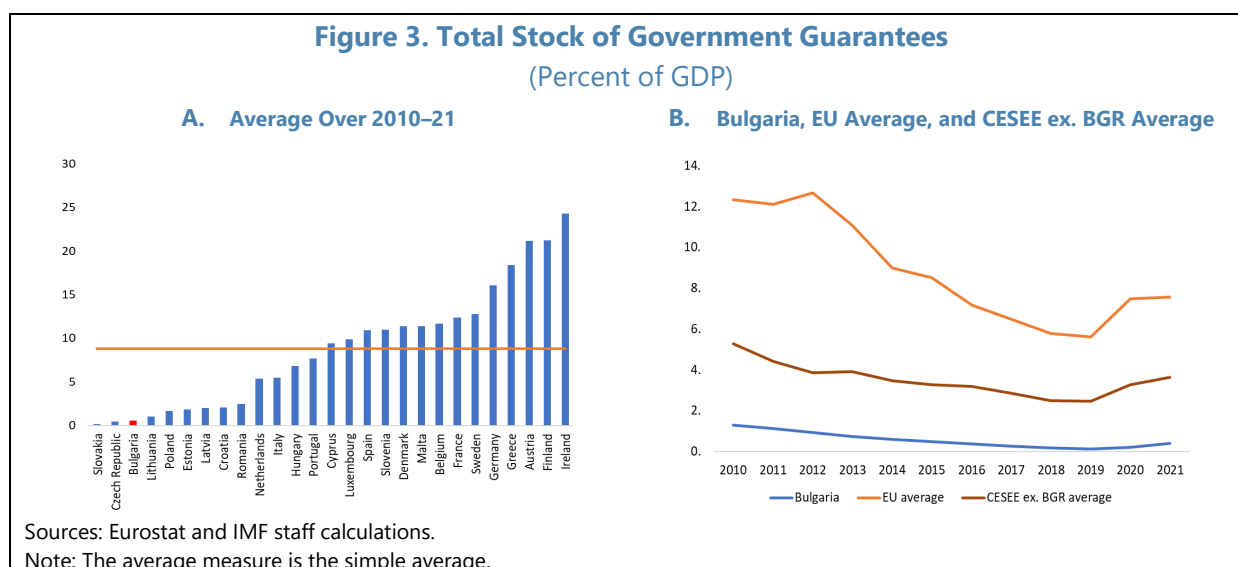
<sup>2</sup> The data is from the Orbis database.

need to provide support, for example in the form of subsidy, transfers, or recapitalization, to ensure the continuity of operations of the SOEs and avoid that their arrears negatively impact to the whole economy (Baum and others, 2020).

**3. The purpose of this paper is to shed light on the fiscal risks from Bulgaria’s SOEs.** First, it considers fiscal risks from SOEs from an aggregate perspective based on the state-guaranteed debt, contingent liabilities, and the budgetary impact of SOEs. Second, it uses firm-level data to assess the risks emanating from important SOEs in the energy and transportation sectors by assessing their financial performance (profitability, liquidity, and solvency) using the IMF’s SOE Health Check Tool (IMF, 2021). The last section of the paper concludes and recommends policies.

## B. An Aggregate Perspective

**4. The level of state-guaranteed debt of SOEs is small and does not pose a fiscal risk concern.** The explicit state-guaranteed debt of SOEs was only 0.5 percent of GDP on average over 2010–21, far below the average of 9 percent in EU countries and 3.5 percent of GDP in other CESEE countries (Figures 3A and 3B). Since the COVID pandemic, the level of state guarantees has increased across Europe, reverting a decade-long downward trend, but only modestly in Bulgaria. Specifically, the EU’s state guarantees of SOEs (as percent of GDP) increased by almost 2 percentage points during 2019–21, while the corresponding increase was only 0.3 percentage points in Bulgaria.

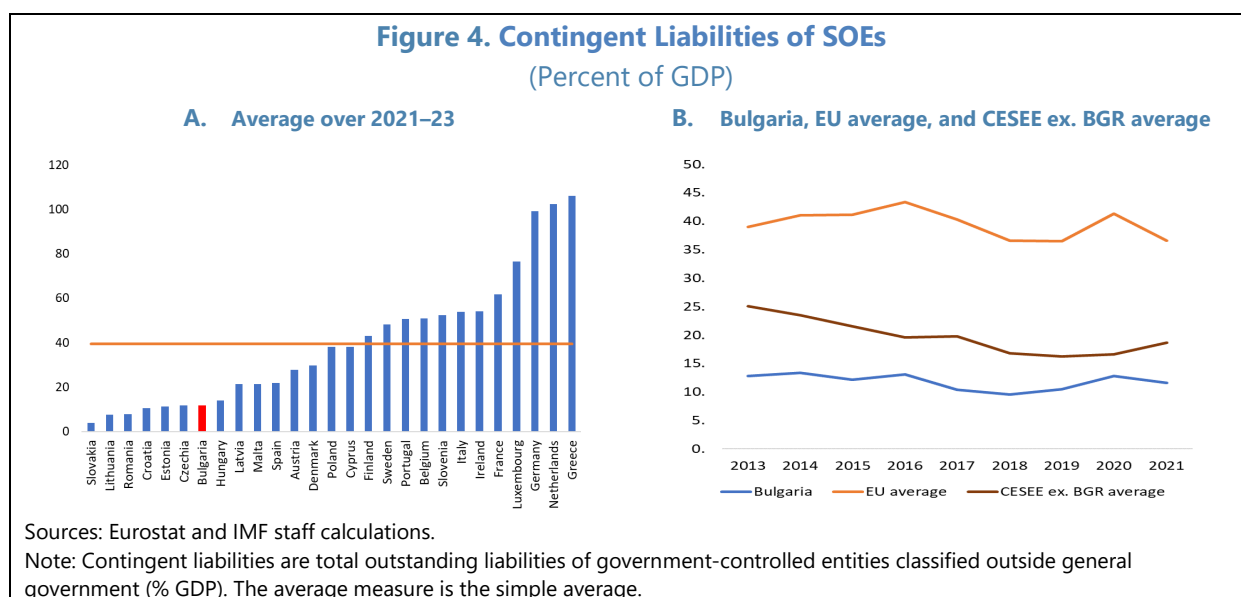


**5. Aggregated information on guarantees issued by SOEs themselves is not available.**

While the size of these guarantees may be insignificant, the lack of information could be a concern as SOE’s issuance of guarantees does not require the approval or monitoring of the Ministry of Finance (Olden and others, 2017). Collecting and publishing data on such guarantees is important to ensure proper monitoring of possible associated fiscal risks.

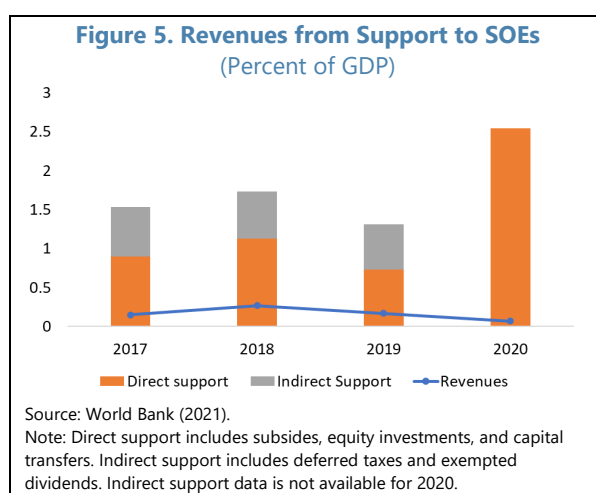
**6. Contingent liabilities from SOEs, while being smaller than other EU counterparts, pose a potential risk for Bulgaria.** The total amount of liabilities of government-controlled entities

classified outside general government was about 12 percent of GDP on average over 2013–21 (Figure 4A). This sizeable level of liabilities can be a source of concern, particularly when considering the SOEs' low profitability (as discussed below). From a historical perspective, the share of SOEs in the Bulgarian economy decreased significantly (Böwer and Paliova, 2016), lessening contingent liabilities over the years. The SOEs restructuring started in the 1990s when SOEs accumulated large losses and arrears and included large one-off recapitalizations enterprises that aimed to break the inter-enterprise chain of arrears leading to an accumulation of tax arrears.



## 7. Fiscal support to SOEs has been higher than their revenue contribution to the budget.

Over 2017–19, the average government support to the SOEs was about 1.5 percent of GDP annually, including both direct fiscal support (subsidies, equity investments, and capital transfers) and indirect (deferred taxes and exempted dividends) (Figure 5). On the other hand, the annual contribution of SOEs to the budget was about 0.2 percent of GDP in 2017–19, indicating a net fiscal support of about 1.3 percent of GDP. In 2020, while the direct support increased significantly to about 2.5 percent of GDP to help SOEs cope with the negative impact of the COVID pandemic, the revenue contribution fell to less than 0.1 percent in 2020, leading to a deficit of about 2.5 percent of GDP. This highlights how unexpected shocks can significantly result in large fiscal costs originating from SOEs.



## 8. High dividend ratio supports the budget but can have negative impacts on SOEs' investment, productivity and profitability. The budget 2023 increased the dividend ratio to

100 percent from 50 percent, expected to boost budget revenues by 670 million leva (or 0.35 percent of GDP). The budget 2024 maintains a 100 percent dividend policy, which is also assumed in the 2025–26 medium-term budget framework. While a higher dividend payout ratio helps improve fiscal revenue temporarily, sustaining high dividend ratio would reduce incentives to improve productivity and profitability. It could also curtail SOEs' investment capacity, by limiting the amount of retained earnings available for investment. In the long run, this may prove a costly strategy not only for the SOEs themselves but also for the broader economy given the vital role of SOEs in the production network (IMF, 2020). Furthermore, dividend policy lacks predictability and appears to be guided by government budget needs. Empirical evidence suggests that such a policy uncertainty dampens firms' incentives for investment and, thus, have a sizable adverse effect on economic activity (Fernandez-Villaverde and others, 2015).

### C. Firm-Level Analysis

**9. This section complements the aggregate perspective with a firm-level analysis of fiscal risks by assessing the financial health of major SOEs in Bulgaria.** Table 1 describes the main source of risks and the associated key financial indicators that can be used to assess the potential for those risks to arise. These indicators encompass three aspects—profitability, solvency, and liquidity—to identify risks across the entire portfolio of the key SOEs in recent years. Specifically, *profitability metrics* assess an SOE's efficiency in using its assets to generate returns for its shareholders. *Solvency metrics* evaluate an SOE's ability to withstand unexpected losses, repay its debt in the long term, and continue operating as a going concern. Finally, *liquidity metrics* analyze the ability of an SOE to pay off its current liabilities as they become due. This focus is not only on how much cash a business has but also on how easy it will be for the SOE to convert assets into cash. Table 1 describes the main sources of risk at SOE and key financial indicators that can be used for assessing the potential for those risks to arise.

<b>Fiscal Risk</b>	<b>Main Source of Risk at SOE level</b>	<b>Key Financial Indicators</b>
Lower dividends and taxes	<ul style="list-style-type: none"> <li>• Lower revenues</li> <li>• Higher costs</li> </ul>	Deteriorating profitability indicators
Higher subsidies	<ul style="list-style-type: none"> <li>• Higher cost of subsidized activities</li> </ul>	Deteriorating profitability indicators
Equity injections	<ul style="list-style-type: none"> <li>• Losses eroding equity</li> <li>• Unsustainably high debt levels</li> <li>• Write-off or impairment of assets</li> </ul>	Deteriorating solvency indicators (debt to assets)
Increased borrowing needs	<ul style="list-style-type: none"> <li>• Weak internal generation of cash (often due to poor profitability)</li> <li>• Poor working capital management (collection from debtors and payment of creditors)</li> <li>• Inadequate access to market financing to meet obligations as they fall due</li> </ul>	Deteriorating liquidity or solvency (interest coverage) indicators
Materialization of contingent liabilities	<ul style="list-style-type: none"> <li>• Weak internal generation of cash (often due to poor profitability)</li> <li>• Inadequate access to market financing to meet obligations as they fall due</li> </ul>	Deteriorating liquidity or solvency (interest coverage) indicators

Source: IMF (2021).

**10. Specifically, the analysis focuses on selected 15 large SOEs in two important sectors of the economy: energy and transportation.** This list includes 8 SOEs in the energy sector and 7 in the transportation sector (Table 2, see also PECA, 2022). The total assets and liabilities of these 15 SOEs account for about 70 percent of the total liabilities and assets of all SOEs over 2015–21.<sup>3</sup> Twelve of considered SOEs are also in top 15 largest SOEs in terms of assets.<sup>4</sup> Therefore, evaluating the financial performance of these key SOEs in detail can further help identify sources of fiscal risks arising from the SOEs sector in Bulgaria.

**Table 2. Bulgaria: Selected SOEs for Analysis**

Energy Sector	Transportation Sector
<ul style="list-style-type: none"> <li>• National Electric Company (NEC)</li> <li>• Kozloduy Nuclear Power Plan</li> <li>• Bulgargaz</li> <li>• TPP Maritsa Iztok 2</li> <li>• Electricity System Operator</li> <li>• Bulgarian Energy Holding</li> <li>• Mini Maritsa Iztok</li> <li>• Bulgartransgaz</li> </ul>	<ul style="list-style-type: none"> <li>• National Railway Infrastructure Company (NRIC)</li> <li>• BDZ – Passenger Services, Ltd</li> <li>• Bulgarian Air Traffic Services Authority</li> <li>• Transport Construction and Recovery, TSV</li> <li>• BDZ – Cargo Services, Ltd</li> <li>• Port Varna</li> <li>• Bulgarian Port Infrastructure</li> </ul>

**11. SOEs are less profitable than private firms.** Two measures of the firm profitability can be used (Figures 6a and 6b). First, the return on asset (ROA), measures the allocative efficiency of the company in managing its assets to produce profits. The average ROA across these SOEs over 2015–21 is low, varying between -1 percent and 2 percent. This is far below the average ROA of 10 percent from the private firms.<sup>5</sup> The gap was reduced in 2022 with an average ROA of 9 percent for SOEs compared to 11 percent of private firms, mainly driven by the high ROAs of National Electric Company, Kozloduy NPP, and TPP Maritsa Iztok 2 due to high energy price. The average ROA excluding these three SOEs was 2 percent, in line with historical path. In terms of median value, the gap remains stable at a 6-percentage point difference over the sample (in Figure 6a). Second, the return on equity (ROE) measures the ability of a firm to generate profits using its shareholders capital. SOEs' ROE was on average 20 percentage points lower than private firms' (Figure 6b). While the SOE sector is expected to be somewhat less profitable on average than the private sector because many SOEs carry specific functions to support the government's objectives, the gap in Bulgaria is particularly significant. The ROE gap is much larger than the 4 percentage-point gap documented in countries with better governance scores (IMF, 2020). This is consistent with the

<sup>3</sup> This is based on a sample of about 700 SOEs in Orbis database, excluding Bulgarian National Bank.

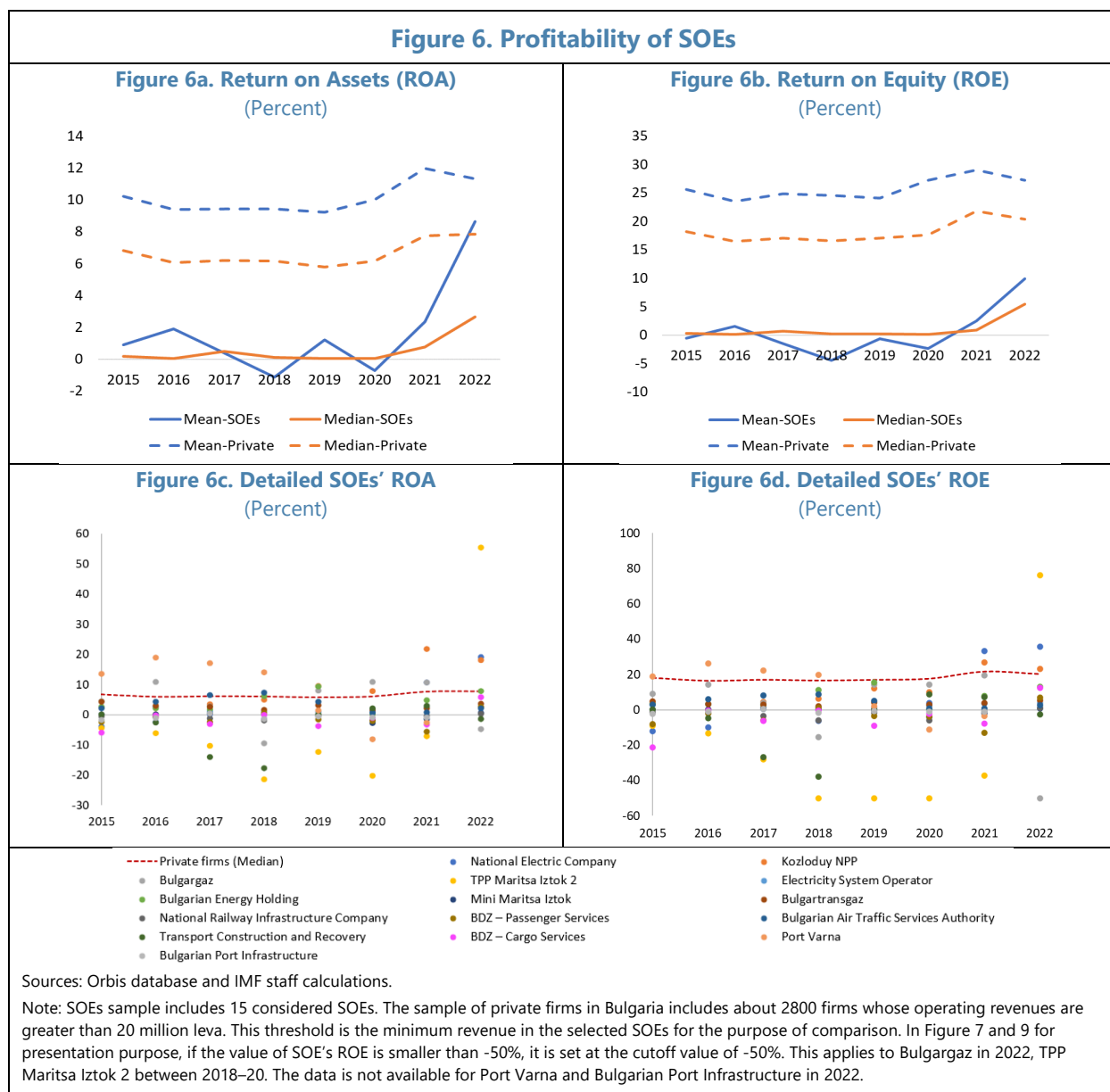
<sup>4</sup> These are: Bulgarian Energy Holding, National Electric Company, National Railway Infrastructure Company, Bulgartransgaz, Kozloduy Nuclear Power Plan, Electricity System Operator, TPP Maritsa Iztok 2, Mini Maritsa Iztok, Bulgarian Port Infrastructure, Bulgargaz, BDZ – Passenger Services, and Bulgarian Air Traffic Services Authority. The other three in top 15 largest SOEs are: Bulgarian Development Bank and two enterprises owned by Sofia municipality (Metropolitan Sofia and Toplofikacia Sofia).

<sup>5</sup> The sample of private firms in Bulgaria includes about 2800 firms whose operating revenues are greater than 20 million leva. This threshold is the minimum revenue in the selected SOEs for the purpose of comparison.



literature’s findings that weak governance in government harms all firms but has an especially deleterious effect on SOEs, (IMF, 2020; Baum and others, 2019).<sup>6</sup>

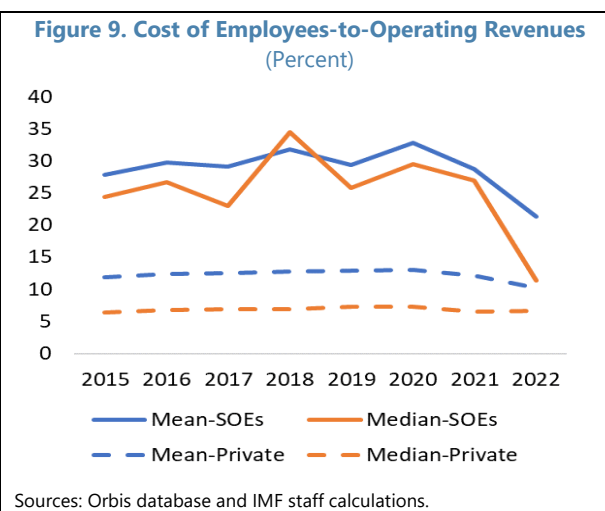
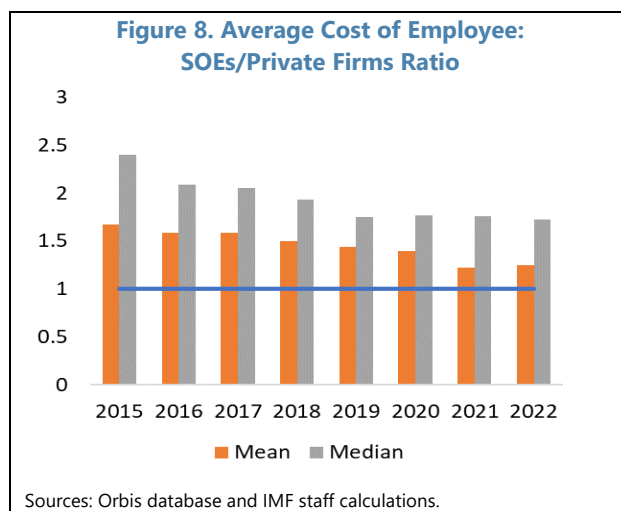
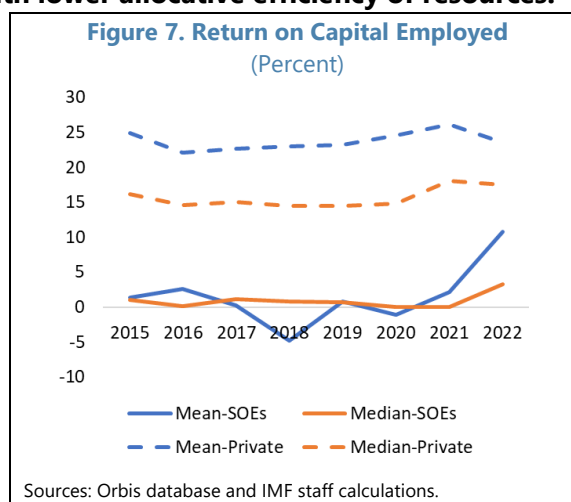
**12. Several SOEs have been continuously making losses.** Over 2015–22, about 6 SOEs made losses on average, including TPP Maritsa Iztok 2, Transport Construction and Recovery, BDZ – Passenger Services, BDZ – Cargo Services, Bulgarian Port Infrastructure, and NRIC (Figures 6c and 6d). The rise in electricity prices boosted profits of some SOEs over 2021–22, particularly the National Electric Company. Excluding these two years, the National Electric Company is another loss-making SOE over the 2015–22 period.



<sup>6</sup> Using weighted average or extending the analysis to about 700 SOEs with data available in the Orbis database leads to similar findings.

### 13. Lower profitability in SOEs is associated with lower allocative efficiency of resources.

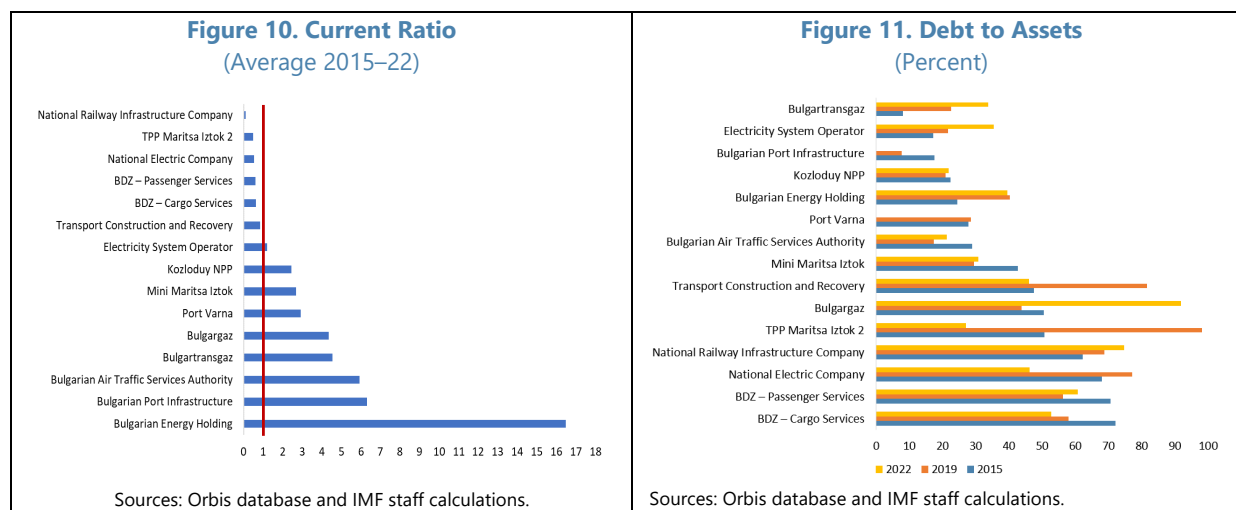
The efficiency of capital of SOEs is usually captured by the return on capital employed (ROCE), which is the operating profit or loss before tax as a share of capital employed. This indicates the efficiency by which the sum of shareholders' equity and debt are used to generate profits. By this measure, the efficiency of SOEs lags the private sector (Figure 7). Similarly, SOEs also perform worse in labor resource allocation. The average cost of employees is higher in SOEs than in private firms, although the gap is getting smaller (Figure 8).<sup>7</sup> Additionally, the cost of SOEs' employees is more than 20 percent of operating revenues, which is double the corresponding value in private firms (Figure 9). Considering the vital role of the SOE sector in the production network, low profitability and inefficiency could impair competitiveness and productivity across the economy.



**14. Notably, some SOEs faced short-term challenges in meeting their liabilities.** The current ratio assesses an SOE's ability to meet its current liabilities from its current assets. On average over 2015–22, about six of considered SOEs had a current ratio of less than 1, indicating that the entity did not have sufficient liquid assets to meet the amounts due to creditors in the short run (i.e., 12 months) (Figure 10). These are National Railway Infrastructure Company, TPP Maritsa Iztok 2, National Electric Company, BDZ – Passenger Services, BDZ – Cargo Services, and Transport Construction and Recovery. Consequently, this led to an accumulation of debt arrears to their

<sup>7</sup> If the payroll in the private sector was underreported systematically (and largely), this could happen too. However, this possibly occurs at small-size firms where it is difficult to monitor and audit. Our sample of private firms includes about 2800 firms whose operating revenues are greater than 20 million leva, for which the issue of underreporting is less likely.

suppliers, which were then paid by a (bridge) loan and/or by state aid.<sup>8</sup> Additionally, arrears can cause a contagious liquidity risk between SOEs that could also affect those with a high current ratio. For instance, despite a high current ratio, Bulgargaz faced a liquidity crisis in mid-2022 due to the low collection of receivables and debt arrears from the Sofia district heating company (as shown by high debt/credit turnover time in Table 5 and 6). Furthermore, arrears to suppliers may contribute to the rise of nonperforming loans of the banking system (Böwer and Paliova, 2016).



**15. Several major SOEs have a high debt-to-asset ratio, thus posing a concern on solvency risks.** SOEs with higher levels of liabilities compared to assets are in a riskier position because they have less financial flexibility. An SOE whose debts exceed its assets—that is, where the indicator is greater than 100 percent, and has negative equity—is technically insolvent. Two important features are salient (Figure 11). First, the debt-to-assets ratio has increased over time in several SOEs including Bulgartransgaz, National Railway Infrastructure Structure, Bulgaria Energy Holding, and Electricity System Operator. Second, the debt-to-assets dynamics can change abruptly: in the case of Bulgargaz, it rose from about 45 percent in 2019 to above 90 percent in 2022. Combining high debt with low profitability raises a concern about the ability to service debt and, therefore, fiscal risks.

**16. The IMF’s State-Owned Enterprise Health Check Tool (IMF, 2021) is applied to provide a comprehensive assessment of the fiscal risks at the firm level.** The tool presents the risks associated with metrics of profitability, liquidity, and solvency. Twelve indicators are associated with the metrics (Table 3).

<sup>8</sup> For example, in 2016, Bulgarian energy holding issued bond to re-finance and bridge loan, borrowed for repayment of the arrears of National Electric Company.

**Table 3. Bulgaria: Financial Indicators in Three Metrics: Liquidity, Solvency, and Profitability**

Ratios	Description
<b>Liquidity</b>	
<b>Current Ratio</b>	Measures an SOE's ability to meet short-term liabilities (those falling due within 12 months) from liquidating short-term assets. A high ratio indicates that the company is better able to withstand shocks and still meet its current liabilities
<b>Quick Ratio</b>	A stricter form of current ratio, this measures an SOE's ability to meet short-term liabilities with only the most liquid short-term assets. A high ratio indicates that the company is better able to withstand shocks and still meet its current liabilities
<b>Debtor Turnover Days</b>	Measures the speed with which a company is paid by its customers. A high ratio could indicate that the SOE is taking a long time to collect amounts owed by its customers and may face increasing liquidity challenges.
<b>Creditor Turnover Days</b>	Measures the speed with which an SOE pays its suppliers. A high ratio indicates that the SOE pays its suppliers more slowly and may indicate the build up of arrears or worsening financial condition.
<b>Solvency</b>	
<b>Debt to Assets</b>	Measures the proportion of a company's financing that comes from liabilities. This ratio helps to assess whether the company is solvent and the size of the debt burden on the entity. Debt financing is more cost-effective and therefore most companies maintain some level of leverage, but a high ratio indicates greater reliance on debt financing and has less financial flexibility.
<b>Debt to Equity</b>	Measures the proportion of a company's financing that comes from liabilities relative to equity. This ratio helps to assess whether the company is solvent and the size of the debt burden on the entity. Debt financing is more cost-effective and therefore most companies maintain some level of leverage, but a high ratio indicates greater reliance on debt financing and has less financial flexibility.
<b>Debt to EBITDA</b>	Indicates the ability of a firm to service any debt it holds. The indicator indicates, at the current rate of cash generation, the number of years it would take for the company to generate sufficient cash to pay off all its debt. A higher indicator indicates a more indebted company, where there is a higher risk that it may not be able to service its debt.
<b>Interest Coverage</b>	Indicates whether an SOE is generating sufficient operating profits to cover financing costs and still remain profitable. A high ratio indicates that the entity has more capacity to absorb shocks and still cover its financing costs.
<b>Cash Interest Coverage</b>	Indicates whether an SOE is generating sufficient cash to cover its financing costs. A high ratio indicates that the entity has more capacity to absorb shocks and still cover its financing costs.
<b>Profitability</b>	
<b>Return on Assets</b>	Measures the allocative efficiency of the company in managing its assets to produce profits. A high ratio indicates that larger profits are being generated per unit of asset
<b>Return on Equity</b>	Measures the ability of a firm to generate profits using the capital its shareholders have invested in the company. A higher ratio indicates that the company is generating higher returns for each unit of equity
<b>Cost Recovery</b>	Measures ability to generate adequate revenue to cover operating expenses. A ratio < 1 indicates entity is unable to cover its operating expenses and is not sustainable without supplementary funding. A higher ratio indicates a company better able to withstand shocks and remain profitable and sustainable

Source: IMF (2021).

**17. The tool uses thresholds to define five categories of risks for each indicator.** The risk level of entities increases from low risk (Category 1) to high risk (Category 5) (Table 4). These thresholds are applied to all SOEs throughout the tool to guarantee a consistent comparison between these companies, even though the level of risk may vary by industry. Most of these thresholds are common benchmarks (Halstead and others, 2021), with two exceptions. First, for the ROE, SOEs are classified in the lowest risk category where their ROE exceeds the median return of private firms, which is about 18 percent on average over 2015–22.<sup>9</sup> The low-to-moderate risk rating (Category 2) is for SOEs that generate at least a return of 5 percent - the average of (i) the return of the first quartile of private ROEs (about 7.2 percent) and (ii) the effective rate on government debt (2.9 percent) over 2015–21. Consequently, loss-making SOEs are included in the two highest-risk categories. Second, for the ROA, the thresholds for Categories 1 and 2 are the median and the first quartile of private ROA. Using the risk thresholds derived from the ROE-related thresholds and balance sheet leverage results in similar values.

<sup>9</sup> As mentioned above, the sample of private firms in Bulgaria includes about 2800 firms whose operating revenues are greater than 20 mil leva. This cut-off threshold is the minimum revenue in the group of selected 15 SOEs for the purpose of comparison.

**Table 4. Bulgaria: Risk Thresholds**

		Low- Moderate risk	Moderate risk	Moderate - High risk	High risk
<b>Profitability</b>					
Return on assets	greater than	7%	2%	0%	-5%
Return on equity	greater than	18%	5%	0%	-10%
Cost recovery	greater than	1.5	1.3	1.0	0.8
<b>Liquidity</b>					
Current ratio	greater than	2.0	1.5	1.3	1.0
Quick ratio	greater than	1.2	1.0	0.8	0.7
Debtor turnover days	less than	30.0	40.0	50.0	75.0
Creditor turnover days	less than	30.0	60.0	90.0	120.0
<b>Solvency</b>					
Debt to assets	less than	30%	50%	80%	100%
Debt to equity	less than	50%	100%	150%	200%
Debt to EBITDA	less than	1.5	2.0	3.0	5.0
Interest coverage	greater than	2.0	1.5	1.2	1.0
Cash interest coverage	greater than	3.0	2.0	1.5	1.0
Debt coverage	greater than	0.8	0.6	0.4	0.3

Sources: IMF (2021) and IMF staff calculations.

Note: The threshold set for Category 2 (low-to-moderate risk) means that any indicator with a lower/higher value (depending on the indicator) will be classified as Category 1 (low risk). Indicators lying between Category 2 and Category 3 thresholds, Category 3 and Category 4 thresholds, and Category 4 and Category 5 thresholds will be classified as Category 2 (low-to-moderate risk), Category 3 (moderate risk), and Category 4 (moderate to high risk), respectively. Indicators beyond the Category 5 threshold will be classified as Category 5 (high risk).

**18. In the pre-COVID period, about 30 percent of considered SOEs had risk rating above moderate.** Sustained low profitability was a concern in six or seven SOEs over the three selected years (Table 5). Meanwhile, about half of SOEs were considered as at high liquidity risks with limited ability to meet their current liabilities (based on current and quick ratios). Solvency risk was also a concern to most SOEs, particularly in terms of the ability to service any debt it holds, as measured by the ratio of debt to earnings before interest, tax, depreciation, and amortization (EBITDA). A higher indicator denotes a more indebted company, indicating a higher risk that it may not be able to service its debt. Several SOEs also face the risk of not generating sufficient operating profits to be able to cover their financing costs (as captured by low interest cover) or a higher share of financing comes from liabilities relative to equity (i.e., debt-to-equity ratio). In the pre-COVID period, the overall risk rating identifies about five SOEs with moderate to high fiscal risk, naming National Electric Company (NEK), TPP Maritsa Iztok 2, National Railway Infrastructure Company (NRIC), BDZ – Cargo Services, and Transport Construction and Recovery (TSV).

**19. SOEs' financial performance improved noticeably in 2022.** The COVID-shock did worsen the profitability of SOEs, but the effect was mitigated by fiscal measures (Table 6). Overall, the SOEs with risk ranking from moderate-to-high level for at least one year in 2020–21 are mainly the same as pre-COVID. However, in 2022, the financial performance of almost all SOEs improved significantly, resulting in a favorable overall ranking of moderate or low-to-moderate risks thanks to an

improvement in profitability. The higher energy price helped improve the position of the loss-making SOEs in the energy sector (Figure 12). For the SOEs in the transportation sector, the improved profitability suggests that they could pass the cost to the customers (Figure 13). In contrast, Bulgargaz was the only SOE with moderate-to-high risk ranking due to deterioration of profitability, caused by the impairment of inventories and accrued losses from trade receivables (Figure 14). This highlights the importance of having buffers in case of unexpected shocks.

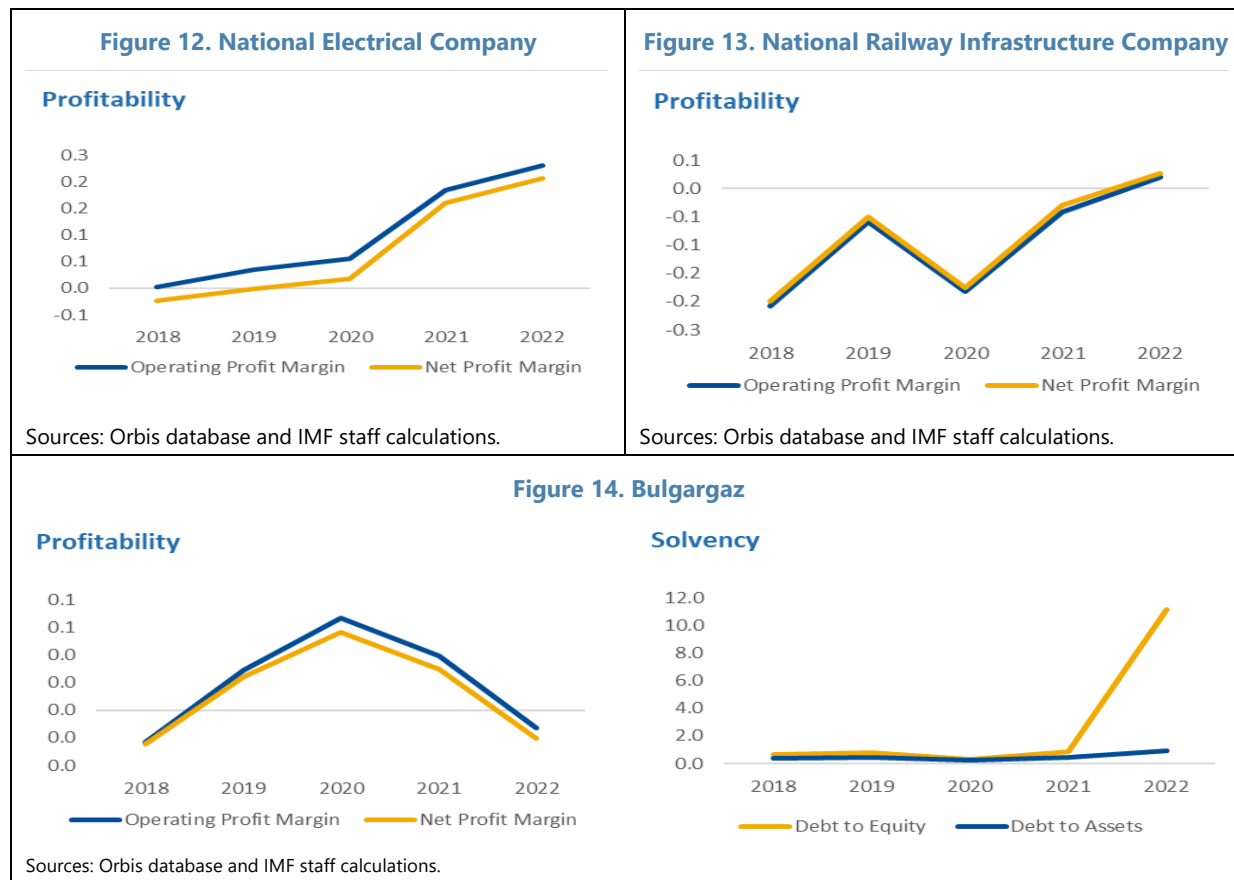




Table 5. Pre-COVID Assessment (Concluded)

C. 2019

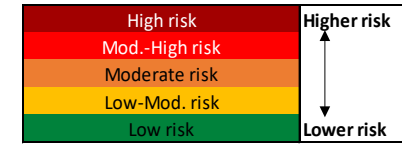
	Profitability			Liquidity				Solvency				Overall Risk	
	Return on Assets	Return on Equity	Cost Recovery	Current Ratio	Quick Ratio	Debtor Turnover Days	Creditor Turnover Days	Debt to Assets	Debt to Equity	Debt to EBITDA	Interest Coverage		Cash Interest Coverage
NRIC	Red	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
BEH EAD	Red	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
BULGARTRANGAZ	Yellow	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
NEK	Red	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
BULGARGAZ	Red	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
ESO EAD	Yellow	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
KOZLODUY	Yellow	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
TPP MARITSA EAST 2	Red	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
MINI MARITSA IZTOK	Red	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
BDZ PASSENGERS	Red	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
BDZ Cargo	Red	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
BULATSA	Yellow	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
BPI	Red	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
TSV	Red	Red	Red	Red	Green	Green	Green	Green	Red	Red	Red	Green	Red
PORT VARNA	Green	Green	Green	Green	Green	Green	Green	Green	Red	Red	Red	Green	Red

Sources: Orbis database and IMF staff calculations.

Note: SOEs are ordered by size of liabilities from largest to smallest. SOEs in the energy sector are coloured in blue in the first column.



Table 6. Bulgaria: Post-COVID Assessment



## A. 2020

	Profitability			Liquidity				Solvency				Overall Risk	
	Return on Assets	Return on Equity	Cost Recovery	Current Ratio	Quick Ratio	Debtor Turnover Days	Creditor Turnover Days	Debt to Assets	Debt to Equity	Debt to EBITDA	Interest Coverage		Cash Interest Coverage
NRIC	High risk	High risk	High risk	High risk	High risk	High risk	High risk	Moderate risk	High risk	High risk	High risk	High risk	High risk
BEH EAD	Moderate risk	Moderate risk	Low-Mod. risk	Low-Mod. risk	Low risk	Low risk	High risk	Low-Mod. risk	Low-Mod. risk	High risk	High risk	High risk	Moderate risk
BULGARTRANGAZ	Moderate risk	Moderate risk	Low-Mod. risk	High risk	High risk	High risk	High risk	Moderate risk	Moderate risk	High risk	High risk	High risk	High risk
NEK	Moderate risk	Moderate risk	Low-Mod. risk	High risk	High risk	High risk	High risk	Moderate risk	Moderate risk	High risk	High risk	High risk	High risk
BULGARGAZ	Low risk	Low-Mod. risk	Low-Mod. risk	High risk	High risk	High risk	High risk	Low risk	Low risk	High risk	High risk	High risk	High risk
ESO EAD	Moderate risk	Moderate risk	Low-Mod. risk	High risk	High risk	High risk	High risk	Low-Mod. risk	Low-Mod. risk	High risk	High risk	High risk	High risk
KOZLODUY	Low risk	Low-Mod. risk	Low-Mod. risk	High risk	High risk	High risk	High risk	Low risk	Low risk	High risk	High risk	High risk	High risk
TPP MARITSA EAST 2	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk
MINI MARITSA IZTOK	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk
BDZ PASSENGERS	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk
BDZ Cargo	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk
BULATSA	Moderate risk	Moderate risk	Moderate risk	High risk	High risk	High risk	High risk	Moderate risk	Moderate risk	High risk	High risk	High risk	High risk
BPI	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk
TSV	Low-Mod. risk	Low-Mod. risk	Moderate risk	High risk	Moderate risk	High risk	High risk	Moderate risk	Moderate risk	High risk	High risk	High risk	High risk
PORT VARNA	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk

## B. 2021

	Profitability			Liquidity				Solvency				Overall Risk	
	Return on Assets	Return on Equity	Cost Recovery	Current Ratio	Quick Ratio	Debtor Turnover Days	Creditor Turnover Days	Debt to Assets	Debt to Equity	Debt to EBITDA	Interest Coverage		Cash Interest Coverage
NRIC	High risk	High risk	High risk	High risk	High risk	High risk	High risk	Moderate risk	High risk	High risk	High risk	High risk	High risk
BEH EAD	Low-Mod. risk	Low-Mod. risk	Low risk	Low-Mod. risk	Low risk	Low risk	Moderate risk	Low-Mod. risk	Low-Mod. risk	High risk	High risk	High risk	Moderate risk
BULGARTRANGAZ	Low-Mod. risk	Low-Mod. risk	Low-Mod. risk	High risk	High risk	High risk	High risk	Moderate risk	Moderate risk	High risk	High risk	High risk	High risk
NEK	Low-Mod. risk	Low-Mod. risk	Moderate risk	High risk	High risk	High risk	High risk	Moderate risk	Moderate risk	High risk	High risk	High risk	High risk
BULGARGAZ	Low risk	Low-Mod. risk	Low-Mod. risk	High risk	High risk	High risk	High risk	Low risk	Low risk	High risk	High risk	High risk	High risk
ESO EAD	Low-Mod. risk	Low-Mod. risk	Low-Mod. risk	High risk	High risk	High risk	High risk	Low-Mod. risk	Low-Mod. risk	High risk	High risk	High risk	High risk
KOZLODUY	Low risk	Low-Mod. risk	Low-Mod. risk	High risk	High risk	High risk	High risk	Low risk	Low risk	High risk	High risk	High risk	High risk
TPP MARITSA EAST 2	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk
MINI MARITSA IZTOK	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk
BDZ PASSENGERS	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk
BDZ Cargo	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk
BULATSA	Moderate risk	Moderate risk	Moderate risk	High risk	High risk	High risk	High risk	Moderate risk	Moderate risk	High risk	High risk	High risk	High risk
BPI	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk
TSV	Low-Mod. risk	Low-Mod. risk	Moderate risk	High risk	Moderate risk	High risk	High risk	Moderate risk	Moderate risk	High risk	High risk	High risk	High risk
PORT VARNA	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk	High risk

**Table 6. Bulgaria: Post-COVID Assessment (Concluded)**

**C. 2022**

	Profitability			Liquidity				Solvency				Overall Risk	
	Return on Assets	Return on Equity	Cost Recovery	Current Ratio	Quick Ratio	Debtor Turnover Days	Creditor Turnover Days	Debt to Assets	Debt to Equity	Debt to EBITDA	Interest Coverage		Cash Interest Coverage
NRIC	Green	Green	Green	Red	Red	Red	Green	Yellow	Yellow	Red	Green	Green	Yellow
BEH EAD	Green	Yellow	Green	Green	Green	Green	Red	Yellow	Yellow	Red	Green	Green	Yellow
BULGARTRANGAZ	Yellow	Yellow	Yellow	Red	Yellow	Green	Red	Yellow	Yellow	Red	Green	Green	Yellow
NEK	Green	Green	Green	Red	Red	Red	Red	Yellow	Yellow	Red	Green	Green	Yellow
BULGARGAZ	Red	Red	Red	Yellow	Green	Yellow	Red	Red	Red	Red	Red	Red	Red
ESO EAD	Yellow	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Yellow	Red	Green	Green	Yellow
KOZLODUY	Green	Green	Yellow	Green	Green	Green	Yellow	Green	Green	Green	Green	Green	Green
TPP MARITSA EAST 2	Green	Green	Yellow	Red	Red	Red	Red	Green	Green	Red	Green	Green	Yellow
MINI MARITSA IZTOK	Yellow	Yellow	Yellow	Green	Green	Green	Green	Yellow	Green	Red	Green	Green	Yellow
BDZ PASSENGERS	Yellow	Yellow	Yellow	Red	Yellow	Green	Green	Yellow	Red	Red	Green	Green	Yellow
BDZ Cargo	Yellow	Yellow	Yellow	Red	Red	Yellow	Green	Yellow	Yellow	Red	Green	Green	Yellow
BULATSA	Yellow	Yellow	Yellow	Green	Green	Red	Green	Green	Green	Yellow	Green	Green	Yellow
BPI													
TSV	Red	Red	Red	Yellow	Green	Green	Red	Yellow	Yellow	Red	Red	Green	Yellow
PORT VARNA													

Sources: Orbis database and IMF staff calculations.

Note: SOEs are ordered by size of liabilities from largest to smallest. SOEs in the energy sector are coloured in blue in the first column. For 2022, data is not available for Port Varna and Bulgarian Port Infrastructure (BPI).

## D. Conclusion and Recommendations

**20. Findings from both aggregate and firm-level based analyses indicate potential SOE-related factors that can contribute to fiscal risks.** Despite a low state-guaranteed debt, concerns arising from the negative net budgetary flows from SOEs coupled with a contingent liability of 12 percent of GDP could lead to long-term fiscal challenges. A detailed firm-level analysis indicates that the profitability of major SOEs is far below that of private firms, partially due to resource allocation inefficiencies. In addition, several SOEs are consistently incurring heavy losses and have difficulties in managing short-term debts, signaling liquidity risks. Some key SOEs also have high liabilities relative to their assets, therefore raising a concern on their long-term solvency.

**21. These issues call for the following policy recommendations:**

- **It is important to closely monitor the financial performance of SOEs and identify mitigation measures accordingly.** This includes: establishing a (digital) unified database, publicly available and frequently updated, on the financial performance of SOEs,<sup>10</sup> making the budgetary flows between SOEs and the government more transparent, and collecting and publishing information on guarantees issued by SOEs themselves.
- **It will be crucial to implement reforms to improve SOEs' financial performance.** SOE reforms, especially reforms of SOE governance—management, oversight, and transparency—can have a positive effect on SOEs' financial performance, increasing worker productivity and lowering costs, particularly in the electricity sector (IMF, 2022). In addition to increasing SOEs' net fiscal contribution, such reforms can thus help boost the overall economic competitiveness and productivity, given the crucial role of SOEs in the production network of the economy.
- **Dividend policies should strike a balance between government interests for fiscal revenue and SOEs' financial sustainability and productivity.** Although the government has a valid claim on SOEs' profits, it is equally important to consider the enterprises' need to retain earnings. Their reinvestment is important to achieve a solid capital structure and make long-term investments to spur innovation and productivity. Additionally, dividend policy should be set in a predictable manner to reduce uncertainty and increase firms' incentives to invest.

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<sup>10</sup> The annual report published by Public Enterprises and Control Agency is a first welcoming step in this direction.

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# BULGARIA IN GLOBAL VALUE CHAINS: LEVERAGING INTEGRATION WITH THE EU<sup>1</sup>

*As a small open economy, Bulgaria relies on economic exchanges with global partners. However, after a boost before the global financial crisis (GFC) and European Union (EU) accession, its integration in global value chains (GVCs) has grown only modestly and remains below peers when it comes to links with EU countries. To capitalize on the integration in the EU single market and leverage the opportunities that will come from joining the euro and Schengen areas, Bulgaria should focus on enhancing its non-cost competitiveness, notably by improving governance and investing in infrastructure and human capital.*

## A. Introduction

**1. Economic integration with the rest of the world can be an engine of growth and development but comes with challenges.** The benefits of integration can be especially large for small emerging market economies like Bulgaria. They include access to larger markets, job opportunities, goods and knowledge sharing, skills enhancement, productivity improvements, and the possibility to focus on the country's comparative advantages (Taglioni & Winkler, 2016; Kummritz, Taglioni, & Winkler, 2017; Constantinescu, Mattoo, & Ruta, 2019; Ignatenko, Raei, & Mircheva, 2019; Pahl & Timmer, 2020). However, to be an active member in global production networks and, ultimately, reap the benefits of integration, a country needs to be attractive to international investors, remain competitive in global markets, and ensure that the gains from trade transmit to the domestic economy (World Bank, 2020). With rising concerns about geoeconomic fragmentation, it is also important that countries ensure the resilience of their global chains through diversification of their input sources (Aiyar, et al., 2023) and, potentially, some reconfiguration of their production and distribution networks (Baba, et al., 2023).

**2. In this paper, we show that Bulgaria's global and regional integration slowed significantly in the last decade.** In the leadup to EU accession in 2007 and the 2008-09 GFC, Bulgaria received large foreign direct investment (FDI) inflows and its integration in GVCs, especially European ones, grew substantially. Then, following a trend common to many European (and non-European) countries, the growth of Bulgaria's participation in GVCs lost impetus in the mid-2010's. These developments left the country with levels of integration with EU partners that remain among the lowest across peers. While economic ties with Russia are declining since 2022, those with China are slowly rising, although they remain limited. Despite some increase in complexity in recent years, we find that Bulgaria largely specializes in low-technology, labor-intensive exports, a result consistent with previous studies (Taglioni & Winkler, 2016; Ivanova & Ivanov, 2017).

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<sup>1</sup> Prepared by Giacomo Magistretti and Iglia Vassileva (both EUR). The authors thank Jean-François Dauphin, Jean-Jacques Hallaert, and Anh Dinh Minh Nguyen for their useful comments and suggestions, and staff of the Bulgarian National Bank and participants at a seminar at the Ministry of Finance for useful discussions.

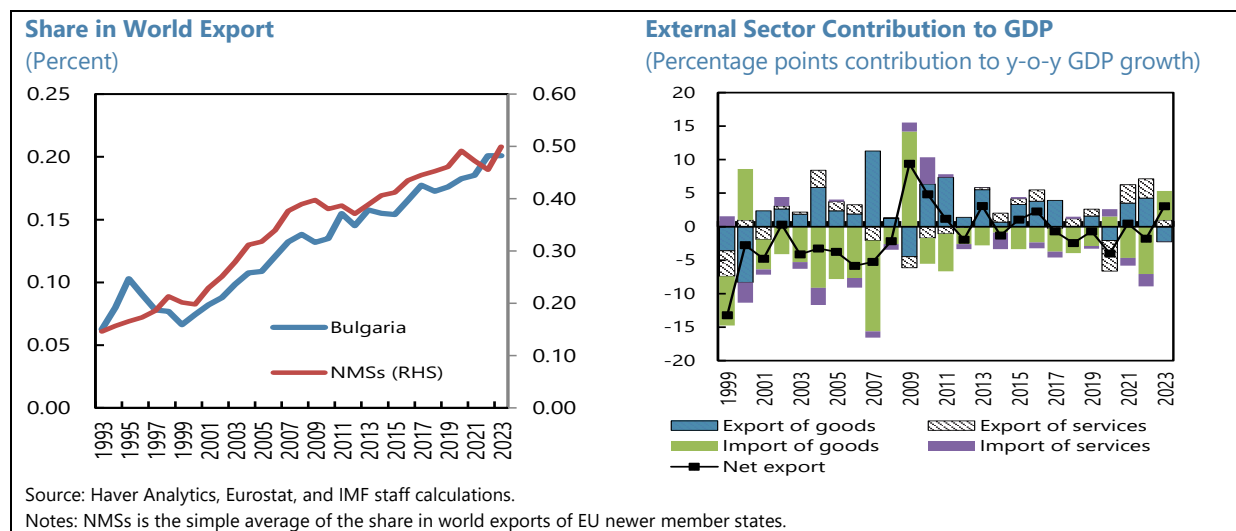
**3. To boost integration and harness benefits from the eventual euro and Schengen areas accession, Bulgaria should improve its non-price competitiveness.** One of Bulgaria's main comparative advantages has historically been the availability of low-cost labor. However, as wages converge toward the EU average, it is crucial that the country focuses on bolstering other aspects of its economy. Our analysis shows that investing in infrastructure, human capital, innovation, and better governance would boost Bulgaria's GVC integration. By improving the economic environment, these policy actions would also make Bulgaria an increasingly attractive destination for investors, including those looking to relocate in Europe amidst geoeconomic fragmentation (Aiyar, Malacrino, & Presbitero, 2024).

**4. The paper is structured as follows.** Section B summarizes recent developments in Bulgaria's external sector, including trade and FDI. Section C examines Bulgaria's position in global production chains based on different metrics of integration. Section D investigates the determinants of GVC participation in a panel of EU countries and compares Bulgaria to EU peers with respect to the identified drivers of GVC integration. Section E concludes.

## B. Developments in Foreign Trade and FDI in Bulgaria

### Trade

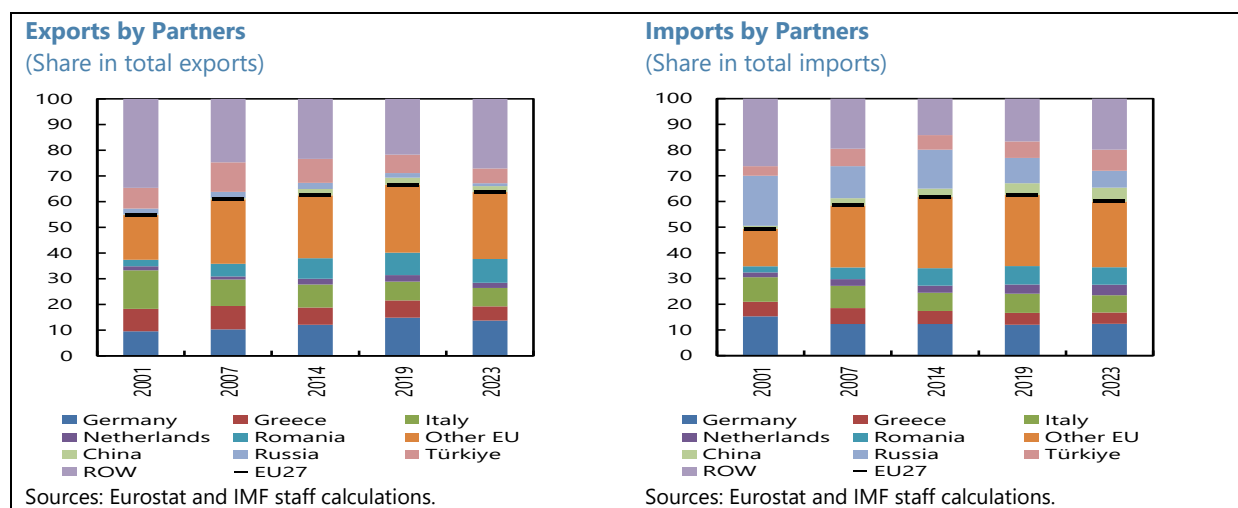
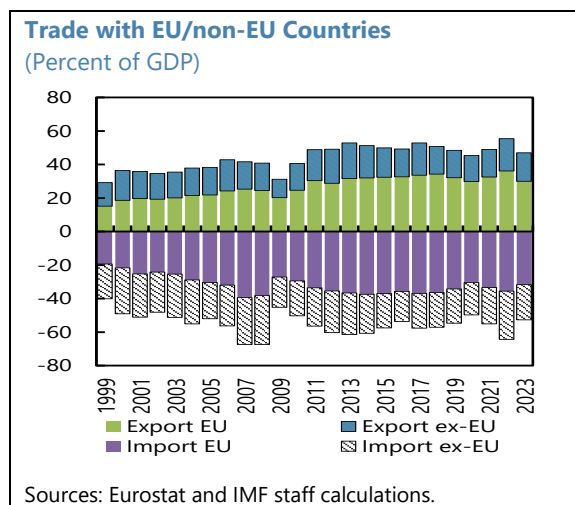
**5. In the past decade, Bulgaria's external sector contributed less negatively to GDP than before the GFC.** Similar to other EU newer member states, Bulgaria's share in world exports steadily increased in the last 3 decades.<sup>2</sup> Meanwhile, imports remained strong owing to high consumption, investment, and import content of exports. The contribution to growth of services has been rising over time, especially since the COVID-19 pandemic.



<sup>2</sup> Throughout the paper, we compare Bulgaria's performance and indicators to either all EU members or, where more meaningful, to a subset of countries that, like Bulgaria, joined the EU after 2004, namely Croatia, Czech Republic, Estonia, Lithuania, Latvia, Hungary, Poland, Slovakia, and Slovenia, thereafter referred to as newer members states (NMSs).

**6. Bulgaria’s integration in EU trade has slowed significantly after the boost experienced in the leadup to EU accession and the GFC.**

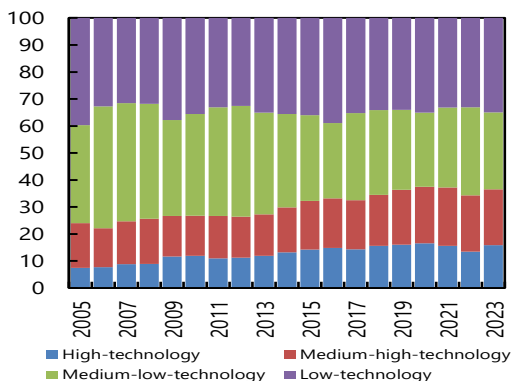
After rising from 15 percent of GDP in 1999 to 25 percent in 2007, Bulgarian exports to the EU have grown more gradually in the last decade. There is a notable increase in the exports to Germany, Romania and, to a lesser extent, China, while the importance of traditional partners such as Italy, Greece, and Türkiye has been declining. Bulgaria’s imports from the EU have decreased lately, except for some neighboring countries. Meanwhile, China, Türkiye and, to some extent, Serbia and US increased their importance as Bulgaria’s suppliers.



**7. Exports are gradually shifting towards more technologically-intensive products, although sophistication remains low.** Bulgaria’s export is relatively diversified, with higher shares in chemicals, refined fuels, non-ferrous metals, food, and machinery. Over the years, there has been a shift towards higher value-added, more high-tech products (Ivanov & Ivanova, 2021). Exports of electrical and other machinery and chemicals have risen, at the expense of textiles, apparel, and some other low-value-added manufactured goods. However, Bulgaria’s export content of productive knowledge, as measured by the Economic Complexity Index (Hausmann, Hidalgo, Bustos, Coscia, & Simoes., 2014), still lags peers and has not increased over the last two decades.

### Exports by Technological Intensity

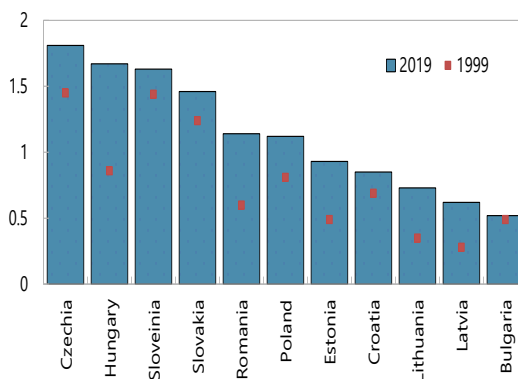
(Share of total export)



Sources: Eurostat and IMF staff calculations.

Note: Export by technological intensity is based on the [Eurostat High-tech classification of manufacturing industries](#).

### Economic Complexity Index of Exports

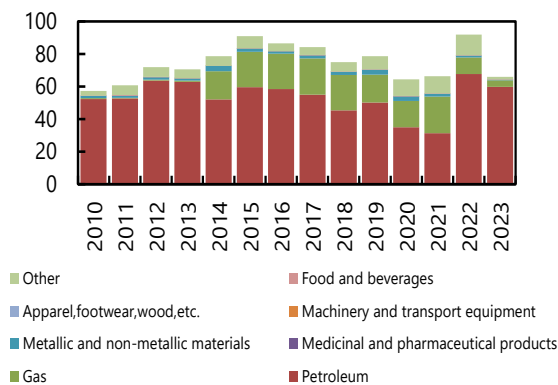


Sources: (Hausmann, Hidalgo, Bustos, Coscia, & Simoes., 2014), (Salinas, 2021), and IMF staff calculations.

Note: The Economic Complexity Index measures the amount of productive knowledge in exports. It is a function of a country's export diversity (number of products exported) and ubiquity (number of countries exporting a product). Red squares are averages 1995-99; blue bars are averages 2015-19.

**8. Recent geopolitical tensions set in motion an energy decoupling from Russia.** Imports from Russia are heavily concentrated in energy products, while exports to Russia are limited. The import of Russian gas has significantly declined in the last two years, following Russia's unilateral decision to stop pipeline gas supply to Bulgaria in April 2022. Meanwhile, import of Russian crude oil increased under the derogation to the EU embargo that the European Commission granted to Bulgaria. A more notable decline in the reliance on Russian oil is expected to be seen only starting from 2024, as the Bulgarian parliament revoked the derogation from March 1, 2024.

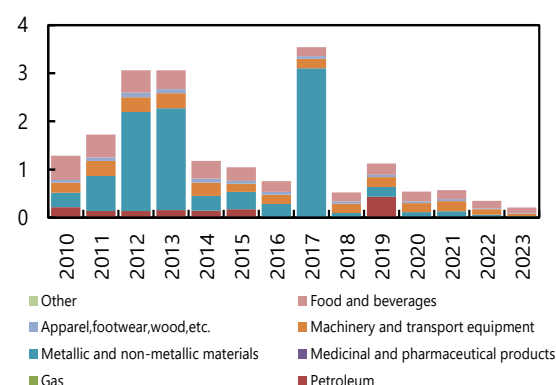
### Imports from Russia (100 million kg)



Sources: Eurostat and IMF staff calculations.

Note: Data for the trade flows with Russia display high volatility due to price and accounting changes.

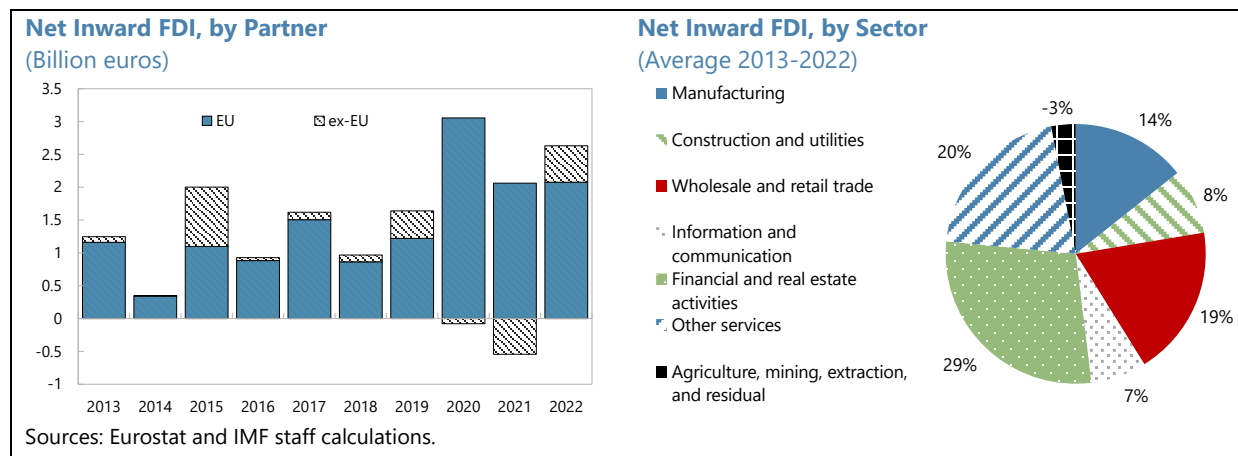
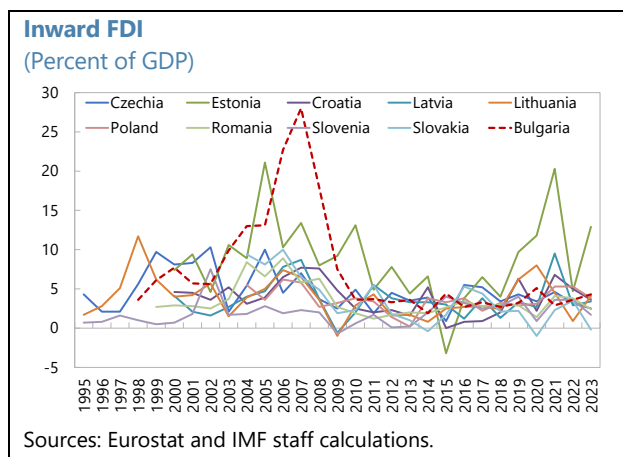
### Exports to Russia (100 million kg)





## Foreign Direct Investment

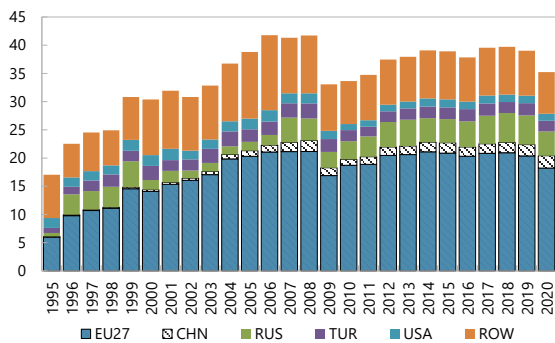
**9. FDI remains substantially below its 2007 peak.** After a boom in the leadup to EU accession and the GFC, foreign investment flows to Bulgaria have significantly slowed and settled to levels similar to other NMSs. In the last decade, FDI largely came to Bulgaria from EU partners. It was mostly concentrated in the services sector, especially financial activities, including real estate, and wholesale and retail trade. As FDI flows and GVC participation often go together (Antràs, 2020; Buelens & Tirpák, 2017), making Bulgaria’s economic environment more attractive to foreign investors would likely also boost integration and allow the country to harness greater benefits from its participation in the EU single market, for instance by attracting multinational firms looking to relocate in Europe.



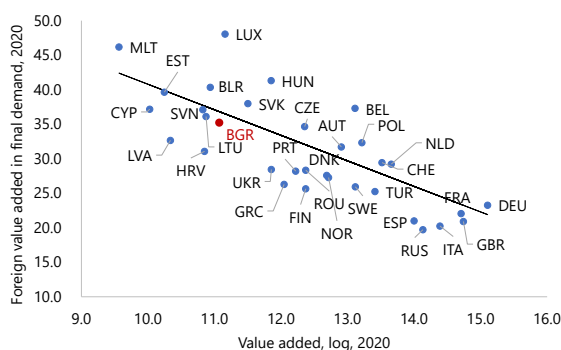
## C. Bulgaria’s Participation in GVCs

**10. Bulgaria relies on foreign production to satisfy a significant portion of its domestic demand.** In 2020, 35 percent of its final demand was met by value added coming from abroad, about half of which from other EU countries. This relatively high foreign reliance is in line with the country’s economic size and remains below pre-GFC levels, with a decline observed in recent years.

**Foreign Value Added in Bulgaria's Final Demand**  
(Percent of total final demand)



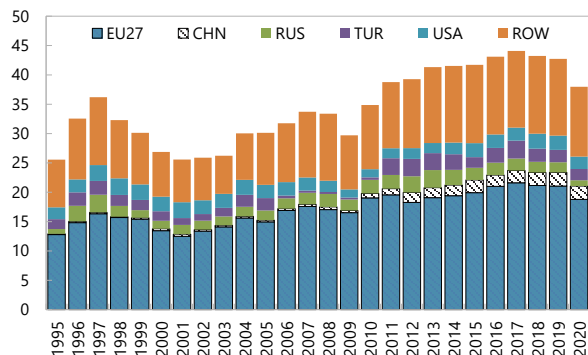
**Foreign Value Added in Final Demand and Economic Size**



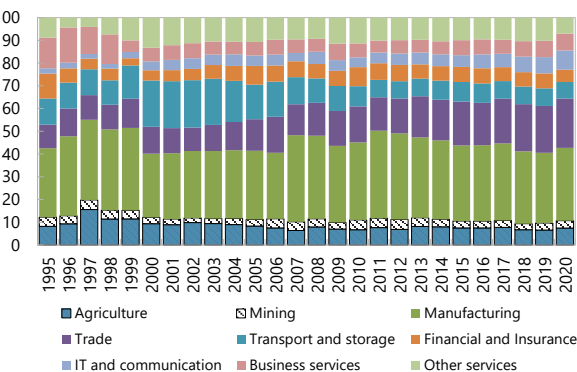
Sources: OECD TiVA 2023 and IMF staff calculations.

**11. Bulgaria also sends a sizeable amount of its value added abroad to satisfy foreign demand, especially in services.** After peaking at almost 45 percent in 2017, Bulgarian value added going abroad declined to about 38 percent of total domestic value added in 2020, close to the EU average. Almost half of the value added sent abroad went to other EU countries. The share going to China has been steadily growing over time, and the Asian country became the largest destination of Bulgarian value added outside the EU in 2020, overtaking the US. About 25 percent of the domestic value added satisfying foreign final demand in 2020 came from the manufacturing sector (including construction and utilities), 13 percent from agriculture and mining, and the remaining 56 percent from services. Consistently with the sophistication trend already observed for exports, the share of wholesale and retail trade and that of IT and communication has been growing steadily over time.

**Bulgaria's Value Added in Foreign Final Demand**  
(Percent of total Bulgaria's VA)



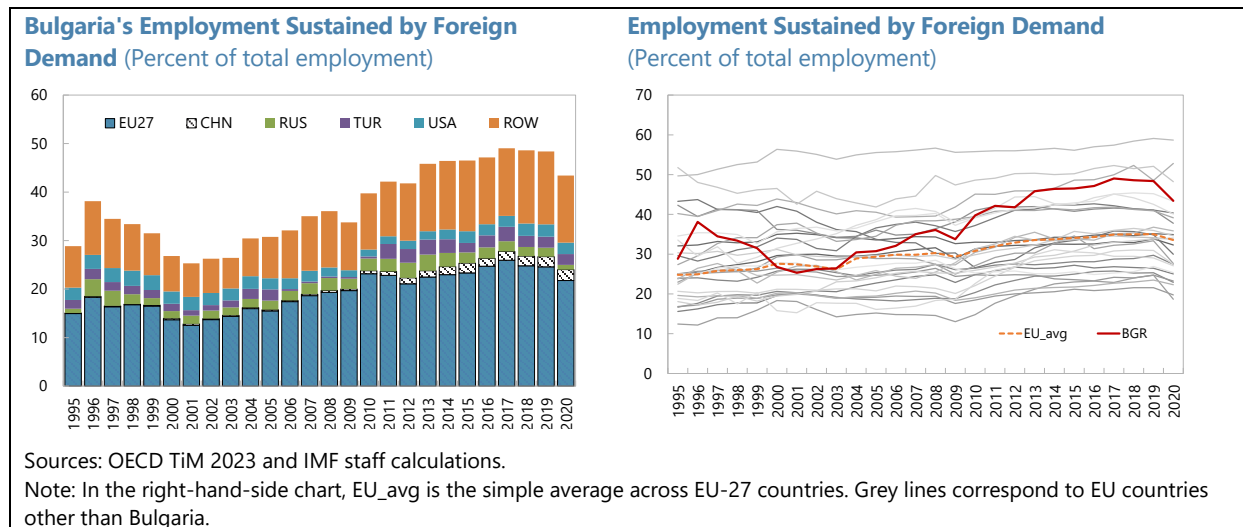
**Bulgaria's VA in Foreign Final Demand, by Industry**  
(Percent of VA in foreign final demand)



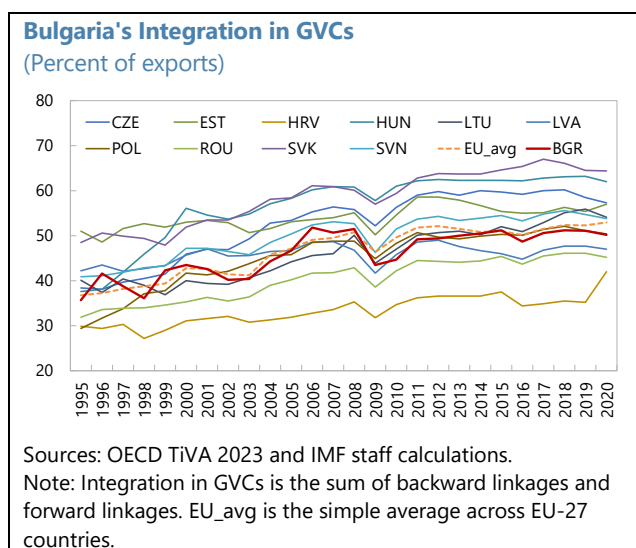
Sources: OECD TiVA 2023 and IMF staff calculations.

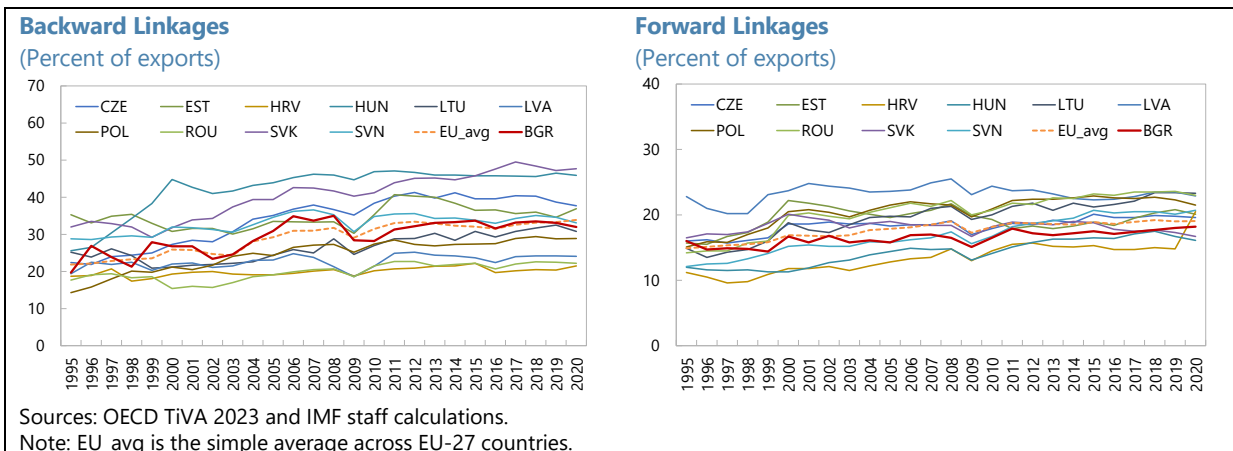
**12. The interconnectedness of Bulgaria with the rest of the world is most pronounced when considering the labor market.** The fraction of Bulgarian employment sustained by foreign demand rose from 35 percent during the GFC to about 50 percent by the end of the 2010's, before slightly declining to 46 percent in 2020. Bulgaria's share is the fourth highest in the EU behind Ireland, Luxembourg, and Malta. Relatively higher foreign dependance for employment vis-à-vis

value added is consistent with earlier findings in the literature noting that Bulgaria specializes in low value-added/labor intensive GVCs (Taglioni & Winkler, 2016; Ivanova & Ivanov, 2017).

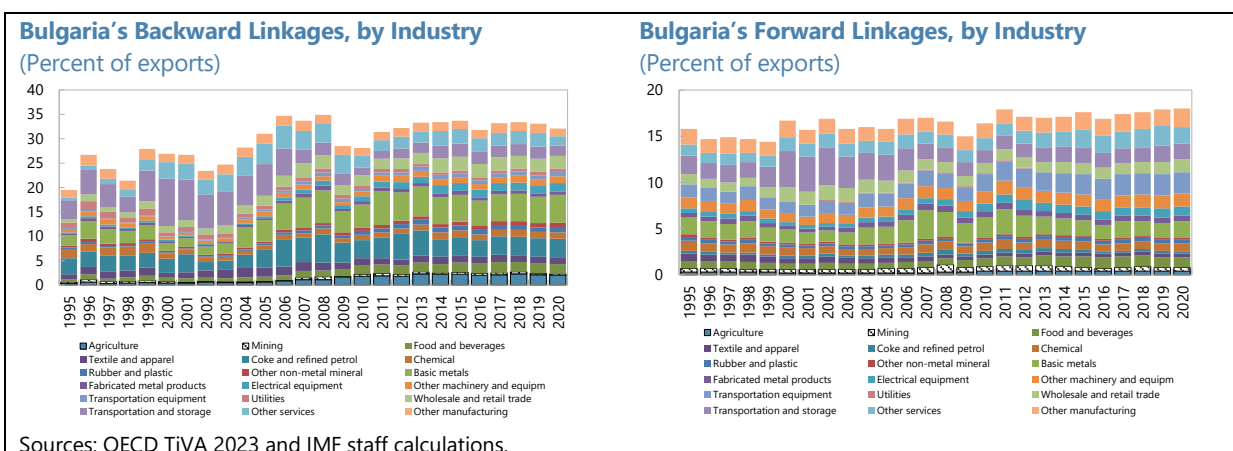


**13. Aggregate metrics of GVC's integration show Bulgaria's involvement slowing in the last decade and lagging peers.** After twenty years of rising integration leading up to EU accession and the GFC, Bulgaria's participation in GVCs declined in 2009, and it only partially recovered in the following two years. After that, Bulgaria's GVC integration increased only marginally. This trend, common to many European countries, leaves Bulgaria's participation in GVC trailing most of NMSs and the EU average, preventing its economy to benefit from deeper global integration. Looking beyond aggregate numbers, backward linkages (i.e., foreign value added embodied in domestic exports) are in line with peers and the EU average. Forward linkages (i.e., domestic value-added content of foreign exports) are, instead, more limited. Although slightly increasing in recent years, they remain below the EU average and more contained than in peer countries.

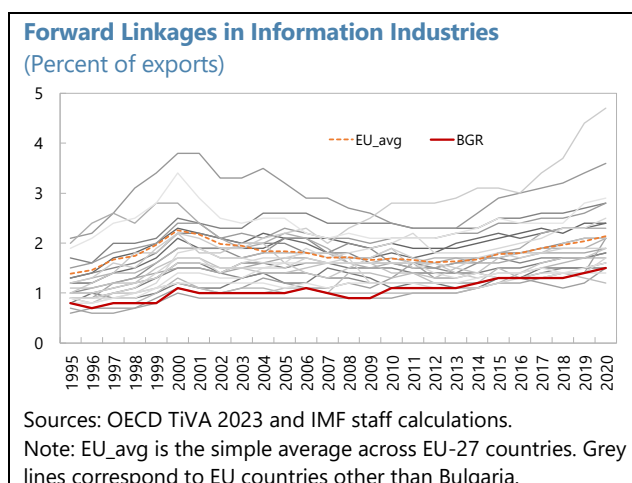




**14. Bulgaria’s GVCs are well diversified.** In terms of backward linkages, the most significant involvement is in GVCs for basic metals and coke and refined petrol products, which accounted for almost a third of total foreign value added in Bulgaria’s exports in 2020. Forward linkages are well-balanced across manufacturing and services industries.

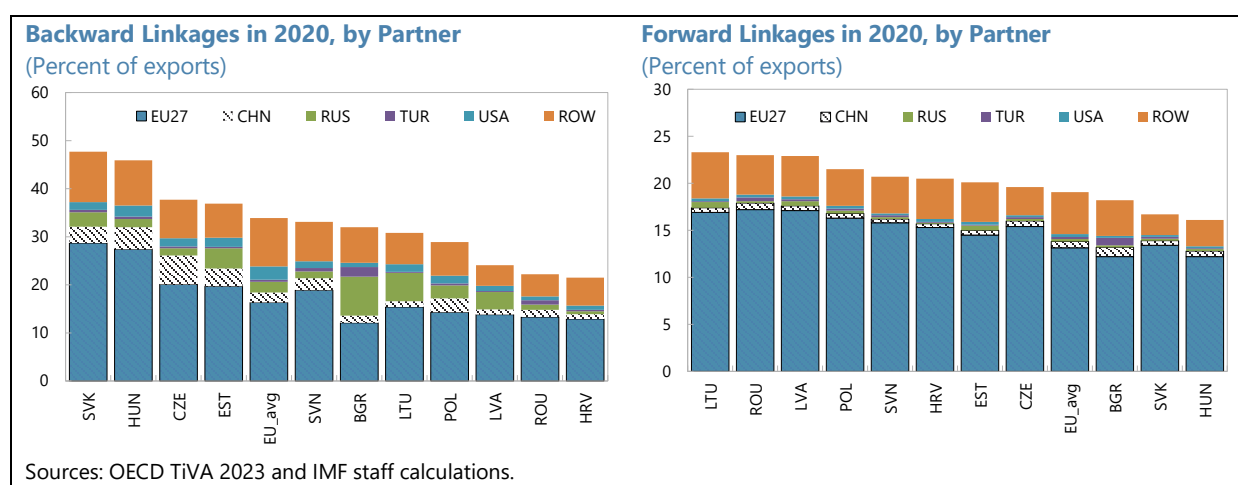
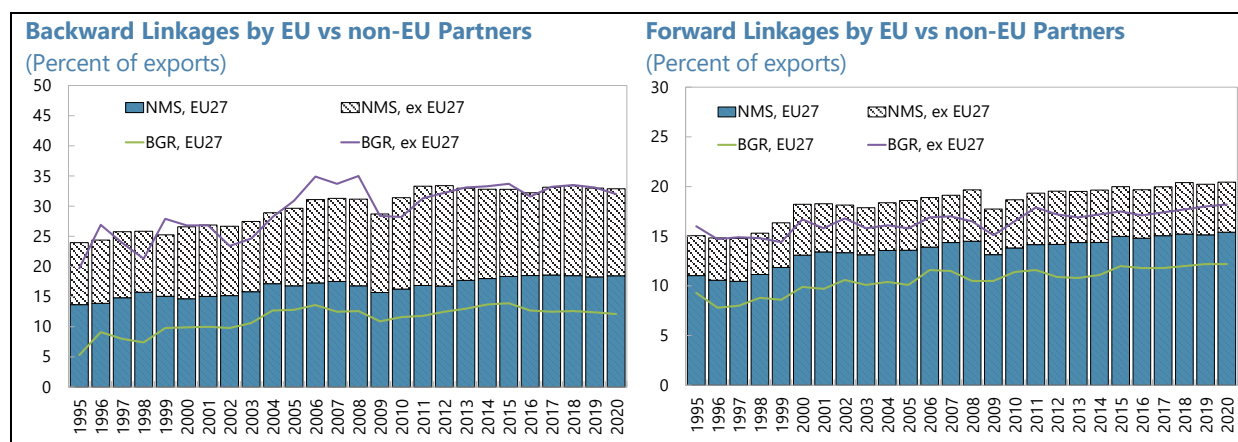


**15. Sophistication of Bulgaria’s GVCs, however, remains low.** Involvement in information GVCs—a proxy for the level of sophistication that encompasses the production of computers and electronics and the provision of communication, IT, and information services—is among the lowest in the EU. Yet, as already observed for exports, Bulgaria is climbing the quality ladder and the sophistication of its GVCs has been slowly increasing. Recent FDI commitments are set to



continue this trend, with the potential to increase Bulgaria’s foothold in rapidly expanding GVCs, such as those for electric vehicles’ batteries.<sup>3</sup>

**16. There is room for further increase in GVC integration with the EU, on both the selling and, especially, the buying side.** Bulgaria consistently lags peers in integration with other EU countries. On the buying side, relatively low backward linkages with the EU have been historically compensated by a significantly larger dependence on Russia and, to a lesser extent, Türkiye. The relatively-large role of Russia as a supplier in Bulgarian value chains was still visible in 2020, the latest available data, when Russian inputs amounted to 8 percent of Bulgaria’s backward linkages compared to 12 percent for EU partners. However, the geoeconomic fallout from Russia’s invasion of Ukraine is expected to weaken the economic relationship between the two countries. On the selling side, Bulgaria’s forward linkages with the EU are the lowest among peers, amounting to 12.2 percent of exports in 2020.

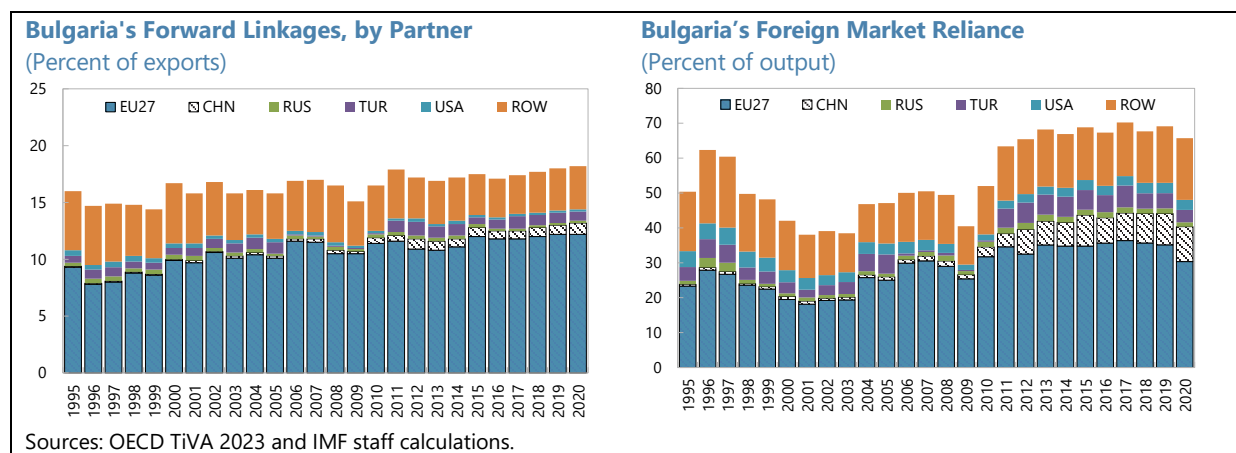


Sources: OECD TIVA 2023 and IMF staff calculations.

**17. Although it remains relatively limited, China’s importance as a buyer in Bulgaria’s GVCs has been steadily growing.** In 2020, China became the largest GVC partner destination for

<sup>3</sup> For instance, the Belgian battery manufacturer ABEE is reportedly planning to invest €1.1 billion in Bulgaria in three sites, a battery factory, a research and development center, and a recycling facility.

Bulgaria's value added outside of the EU. These deepening ties are even more apparent when measured in terms of foreign market reliance (FMR), i.e., the ratio of domestic output used in foreign production to total domestic production, a measure of "total" exposure of domestic activity to downstream disruptions in GVCs (Baldwin & Freeman, 2022; Schwellnus, Antton, Samek, Pechansky, & Cadestin, 2023).<sup>4</sup> The dependence is particularly elevated in sectors such as basic metals and mining and quarrying of non-energy products.



## D. Explaining Bulgaria's Position in GVCs

### Identification of GVC Correlates

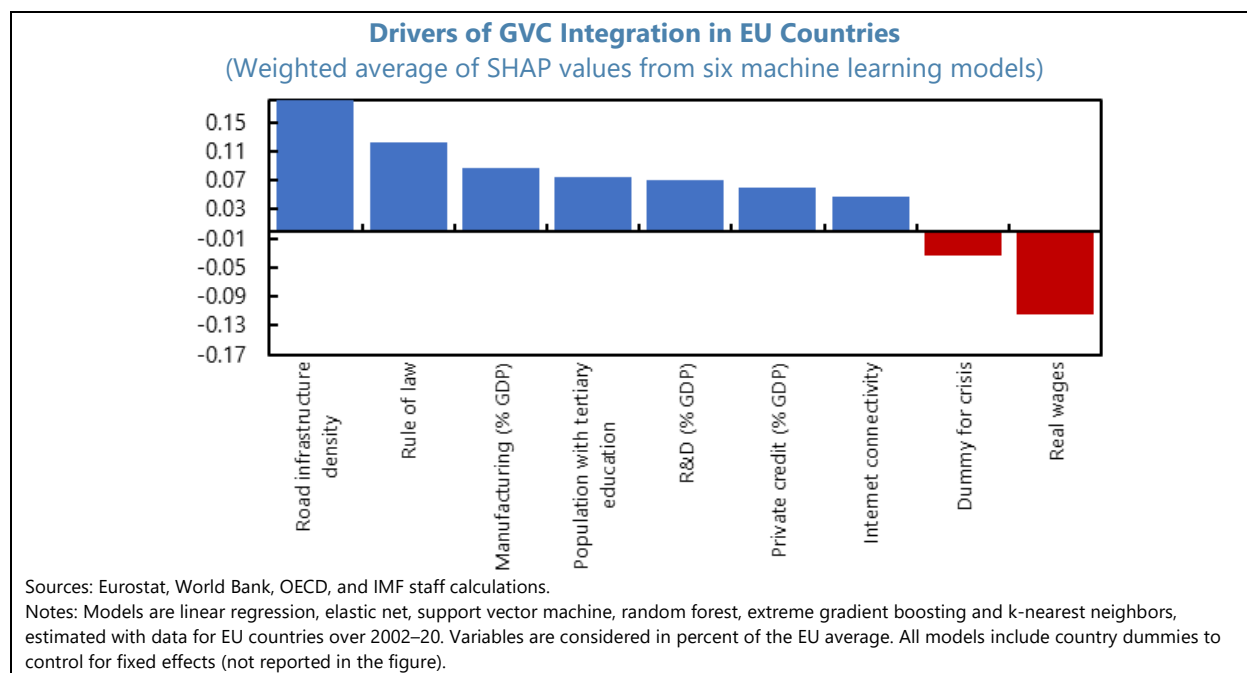
**18. Commonly identified drivers of GVC participation include transport connectivity, cost competitiveness, and institutional quality.** These are part of a broader set of determinants of GVC integration typically identified in the literature (Fernandes, Kee, & Winkler, 2022; Antràs, 2020), which include: (i) land and other natural resources endowments, labor and capital, (ii) geographic position with respect to large GVC hubs, (iii) domestic industrial capacity, (iv) openness to trade (tariffs and free trade agreements) and FDI, (v) institutional quality, (vi) transport connectivity, and (vii) macroeconomic factors, such as cost competitiveness and degree of financial development.<sup>5</sup> Based on these possible contributing factors, our work considers a parsimonious set of key GVC integration drivers for EU countries over the period 2002 to 2020.

<sup>4</sup> Differently from GVC forward linkages, FMR also considers Bulgaria's exports consumed in the destination countries, not only those that enter the production of foreign exports. Moreover, FMR is based on gross trade flows, whereas forward linkages only consider the value-added component of trade. As such, FMR "double counts" the value added of inputs that cross borders multiple times. However, precisely because of this feature, FMR considers not only the size of the exposure to a partner, but also the distance from that partner in global chains. Implicitly, FMR assumes that the entire shipment (not only its value-added component) can be held up at any point in the global supply chain, thus providing a more comprehensive picture of global chain risks.

<sup>5</sup> The relative importance of different factors in this list varies in the literature. Some studies find evidence of a significant impact of factor endowments, country's geographic position, institutional quality, trade policies and FDIs and domestic industrial capacity (Fernandes, Kee, & Winkler, 2022). Other studies establish that openness, FDIs, labor force quality, infrastructure and governance are the most important determinants of GVC participation (Urata & Baek, 2020).

**19. We estimate a panel regression, using machine learning (ML) techniques.**<sup>6</sup> ML models allow to uncover complex (often non-linear) relationships across variables, while being less susceptible to multicollinearity and endogeneity problems than standard econometric techniques. Considering results from various ML estimation methods, we identify the main correlates of GVC integration. The contribution of each driver in the explanation of the prediction of the outcome variable is measured by SHAP values. The ML models' performance is assessed based on: (i) the coefficients of determination and mean square errors of each model in the test subsample, and (ii) a Diebold-Mariano test, which is used for comparing the forecasting performance between models (see Appendix 1 for methodological details).

**20. Our research shows that infrastructure, cost competitiveness, and governance are major drivers of GVC integration for EU countries.** ML models generally confirm the main correlates of GVC integration identified in the literature. High transport connectivity, strong rule of law, and low wages represent the three main drivers to GVC integration in our models. The structure of the economy—measured by the share of manufacturing in GDP—is also an important determinant. Other identified factors from the literature, namely, the education of the labor force, the level of investment in innovation, the depth of financial markets, and internet connectivity (measured as the share of households using internet) also matter. Finally, our analysis confirms the deceleration in GVC integration during the two most recent crises for which data is available—the GFC and the COVID pandemic (see Appendix 2 for more details on the results from the different ML models).<sup>7</sup>



<sup>6</sup> The empirical literature on the determinants of GVC integration is increasing. Existing studies rely on a variety of methodological approaches, including country-level panel regressions and gravity models with country fixed effects (Fernandes, Kee, & Winkler, 2022; Ignatenko, Raei, & Mircheva, 2019; Buelens & Tirpák, 2017) and firm-level data to determine firm-level drivers of GVC participation (Urata & Baek, 2020).

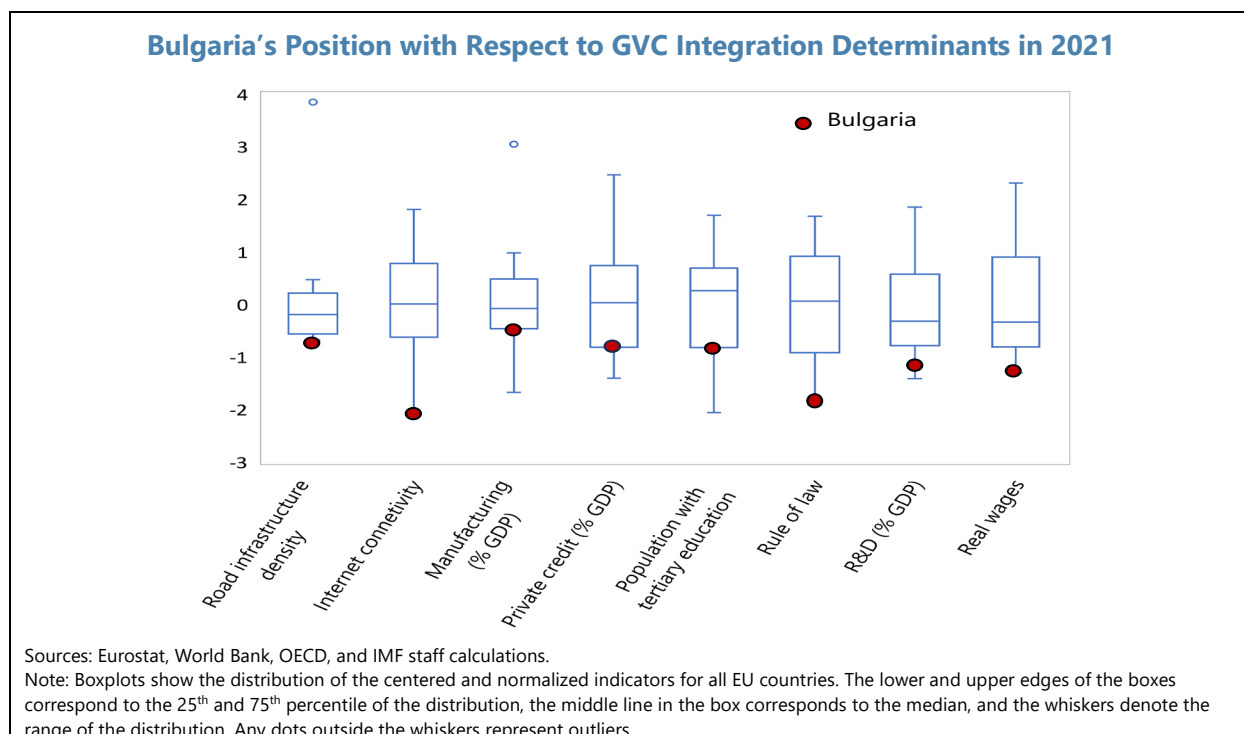
<sup>7</sup> The available vintage of the OECD TiVA database includes data only up to 2020 at the time of this publication. Therefore, our work does not cover the impact of Russia's war in Ukraine on European GVCs.

## Bulgaria's Position with Respect to GVC Drivers in the EU Landscape

**21. Bulgaria belongs to the group EU countries benefiting from low labor costs, but with deficiencies in infrastructure, financial intermediation, and rule of law.** A cluster analysis based on the dataset used for the ML models shows that, with respect to the drivers of GVC participation, Bulgaria belongs to a group of (mostly) small open EU economies. This group is characterized by relatively low wages, less developed infrastructure and financial intermediation, and predominantly low rule-of-law scores (see Appendix 3 for details on the cluster analysis and its results).

**22. Bulgaria will need to move from cost to non-cost competitive advantages to increase its participation in GVCs.** With respect to the identified key determinants of GVC integration, Bulgaria has had a relative advantage, by EU standards, in cost competitiveness, given that it has the lowest real wage in the EU. However, as wages in Bulgaria are catching up with the EU average, this cost advantage is eroding. Therefore, Bulgaria will need to boost its non-cost competitiveness to maintain and, ideally, deepen its GVC integration.

**23. Bulgaria can significantly improve its integration in GVCs by stepping up investment in transport infrastructure and strengthening governance.** The most important non-cost competitiveness correlates of GVC integration are the density of road infrastructure and the rule of law—both areas in which Bulgaria substantially lags its peers. Additionally, there is scope to invest more in R&D and internet connectivity, where there is a notable gap between Bulgaria and other EU countries. Relatively to other correlates, Bulgaria is faring better in terms of industrial intensity of the economy, share of labor force with a tertiary degree, and financial intermediation development, although there is room for significant improvements also in these areas, especially in the quality of education.





## E. Conclusion

**24. Bulgaria has room to increase its integration with the EU.** Bulgaria's GVCs display substantially lower levels of integration with EU partners than many peers. The prospects of joining the euro and Schengen areas provide opportunities for forging stronger ties with countries in the region. A deeper integration, however, would require Bulgaria to fill gaps with EU peers to make its economy more competitive and attractive for foreign investors.

**25. Links with Russia are weakening, while ties to China are on the rise.** Russia has historically played an outsized role as a supplier for Bulgaria's GVC inputs, especially energy products. However, since Russia's invasion of Ukraine in 2022, a decoupling is unfolding. On the selling side, China's foothold in Bulgaria's global production chains has been rising since the GFC, with several measures showing China as the largest non-EU buying partner in recent years.

**26. As the cost advantage erodes, Bulgaria needs to improve its non-price competitiveness.** Our analysis shows that investing in infrastructure and R&D, improving governance and the business environment, and enhancing the skills of the workforce will take Bulgaria closer to its EU peers, thereby providing a more conducive environment to boost the country's integration in GVCs. Improvements in these areas will also help Bulgaria increase the sophistication of its exports and climb the value ladder, consistently with the country's convergence toward more economically advanced EU countries.

## Appendix I. Application of Machine Learning Models to the Analysis of the Drivers of GVC Integration

### Data Sources and Transformations

1. **The GVC data used in our analysis come from the OECD TiVA dataset, 2023 vintage.** As for the drivers of GVC integration, most of the data are sourced from Eurostat as of April 17, 2024. The World Bank World Development Indicators database was used for the share of private credit in GDP and the World Governance Indicators for institutional quality. Road infrastructure density indicator comes from the OECD transport infrastructure database.

2. **Since some of the machine learning methods are sensitive to scaling, before the application of the ML methods, the data has been centered and standardized to put all variables on the same scale.** All explanatory variables have been calculated as a percentage of their EU average values to isolate the country-specific component of the dynamics.

### Machine Learning Models

3. **ML methods include various computational algorithms, which aim at identifying patterns in a dataset.** Their main advantage is that they can capture relationships in the dataset that might be complex and difficult to model explicitly. While the ML methods have been developed mainly for forecasting purposes, recent advances in the field allow to use them for estimation purposes as well.

4. **As per the usual practice in ML, we split the dataset into training (used for model fitting) and testing** (for checking the performance of the model). In all models, we use 75 percent of the data for training and the remaining 25 percent for testing.

5. **We set the main models' hyperparameters (i.e., the parameters of the ML methods) using a cross-validated grid-search over a predefined parameter grid.** The cross validation is a resampling procedure, where the dataset is split into 'k' subsamples. One subsample is treated as test data and the rest as train data. This procedure is repeated several times and the average outcome is reported.

6. **The ML methods applied in this work are:**

- **Linear Regression.** While this method is relatively simple, it inherently assumes a linear relationship in the data. Moreover, linear regression is more subject to overfitting and sensitive to outliers.
- **Elastic Net.** This method is an extension of the linear regression, where penalties are incorporated in the loss function. As a result, it achieves sparseness in the model definition.

- **Support Vector Regression.** The support vector machine maps the dataset in a higher dimension space, using a kernel, to separate the observations into distinct categories. The support vector regression usually has a good generalization capacity and is robust to outliers. However, it is less effective for large datasets, and in cases when the dataset has more noise.
- **Random Forest Regression.** This method constructs an ensemble of multiple decision trees, thus improving their individual performance.
- **Extreme Gradient Boosting.** The XGBoost builds on the random forest by adding new trees one by one to correct for the prediction errors made by the existing ones. Furthermore, the XGBoost has optimized algorithms, which ensure faster execution.
- **K-Nearest Neighbors.** K-Nearest Neighbors uses proximity as a criterion. For a continuous variable the most popular distance measures include Euclidean, Manhattan, or Makowski distances. The training of the model is performed on the entire dataset and the prediction is made based on the mean or median of the k-most similar observations.

## Methods for Enhancing the Interpretability of Machine Learning Models

**7. Since very few ML models are straightforward to use for analytical purposes, current research focuses on the development of tools for ML model interpretation.** They fall into two categories: summary-based (providing insights about the average contribution of the included features for the explanation of the outcome variable) and instance-based (focusing on a breakdown of a specific observation). The most popular model-agnostic techniques for interpretation include permutation feature importance, Partial Dependence Plots (PDP), Local Interpretable Model-agnostic Explanations (LIME) and SHapley Additive exPlanations (SHAP).

**8. In our work, we use the SHAP values** (Lundberg & Lee, 2017). These are based on the concept of Shapley values from coalition game theory. The Shapley values provide a means to calculate the contribution of each feature value to the outcome prediction minus the average prediction for all instances. More specifically, for each feature  $i$  the Shapley value:

- estimates  $i$ 's expected marginal contribution to the deviation of the outcome projection from its mean;
- is calculated as a weighted average  $i$ 's contribution to all possible combinations of features with its participation.

$$\phi_i(f, x) = \sum_{S' \subseteq X'} \frac{|S'|! (M - |S'| - 1)!}{M!} [f_x(S') - f_x(S' \setminus i)]$$

$\underbrace{\hspace{10em}}$	$\underbrace{\hspace{10em}}$	$\underbrace{\hspace{10em}}$
Sum over all possible combinations of features that $i$ can join	Weights, based on the probability of observing a configuration of features	Change in the marginalized prediction of the outcome variable due to the inclusion of feature $i$

**9. As shown above, the Shapley values are calculated as the average marginal contribution of each feature given all possible permutations of the other features, which makes this approach computationally intensive.** Therefore, the preferred approach is to approximate the Shapley values, instead of calculating them. In particular, we use the Kernel SHapley Additive exPlanations. This approach creates perturbed samples by dropping some features and replacing them with expected values. This derived dataset is then used to train a linear regression, whose coefficients are considered to be proxies for the Shapley values.

**10. SHAP values are widely preferred as they have solid theoretical foundations and satisfy the following useful properties:**

- **Efficiency**—the sum of the feature contributions adds up to the difference of the prediction for the feature value at this instance and the average.
- **Symmetry**—if two features contribute equally to all possible coalitions, their Shapley values would be the same.
- **Dummy**—if a feature does not change the predicted value in all possible coalitions, it has a Shapley value of 0.
- **Additivity**—the Shapley value for an aggregated object is the sum of the Shapley values of its components.

## Appendix II. Detailed Results from the ML Models for the Analysis of the Drivers of GVC Integration

### Machine Learning Models Forecasting Performance

1. **The appropriateness of the machine learning models has been assessed based on their forecasting accuracy.** It is measured by the coefficient of determination and the mean squared error of the models (ran only on the testing subsample) and the Diebold-Mariano test for forecasting performance. The forecast statistics are given in Table 1. Based on it one can infer that all models perform similarly in terms of forecasting accuracy with k-Nearest Neighbors, Support Vector Machine, and Random Forest doing slightly better than the rest of the models.

**Table 1. Machine Learning Model's Forecasting Statistics**

Model	MSE	R2
Linear regression	0.07	0.93
Elastic net	0.07	0.93
k-Nearest Neighbors	0.05	0.95
Support vector machine	0.05	0.95
Random forest	0.06	0.94
Extreme gradient boosting	0.09	0.91

2. **The modified Diebold-Mariano test for forecast comparison<sup>1</sup> also confirms these conclusions** (Table 2). It shows that the SVM and kNN models have a statistically significant better forecasting performance than the other models and that the random forest performs better than the extreme gradient boosting model.

**Table 2. Modified Diebold-Mariano Test for Forecast Comparison**

	Elastic net	Support vector machine	Random forest	Extreme gradient boosting	k-Nearest Neighbors
Linear regression	0.21	2.44**	0.73	-1.35	2.79***
Elastic net		2.43**	0.71	-1.35	2.72***
Support vector machine			-1.02	-2.68***	-0.5
Random forest				-2.34**	0.71
Extreme gradient boosting					2.53**

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Note: A positive sign of the statistics indicates that the model in the column performs better than the model in the row.

<sup>1</sup> We are implementing the (Harvey, Leybourne, & Newbold., 1997) modification of the test proposed by (Diebold & Mariano, 1995), which improves the finite sample properties of the test by correcting the almost entirely the bias of the Diebold-Mariano test – an approximately unbiased estimate of variance of loss differential is obtained.

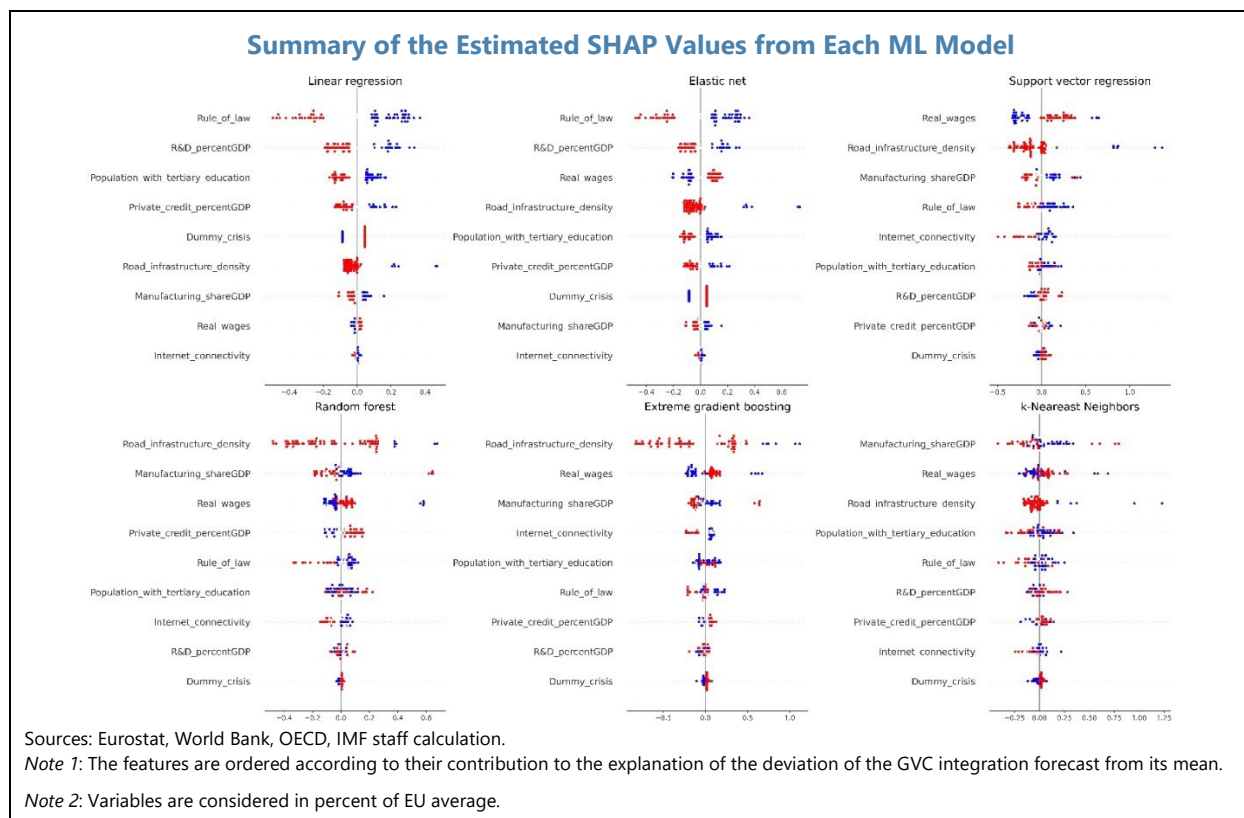
**3. Despite some differences in the forecasting performance of the ML models, overall they perform similarly.** Therefore, we consider all of them and cast our results in terms of the average SHAP values.

### Detailed Results from the Application of the ML Models

**4. The figure below shows the distribution of the SHAP values by feature for each observation in the sample.** A wider spread of the values implies higher variability in the SHAP values, or, equivalently, greater impact of the feature on the forecast of the GVC integration.

**5. Furthermore, the SHAP values are color-coded, based on the original values of the features—high values are blue, low values are red.** Thus, if a feature’s positive SHAP values (i.e., to the right of the vertical line) are blue, it means that higher values of the feature are associated with positive deviations of the output variable forecast from its expected value (e.g., the rule of law). And vice versa, if a feature’s positive values are red (e.g., real wages), this is an indication that there is a negative relationship between the feature and the output variable.

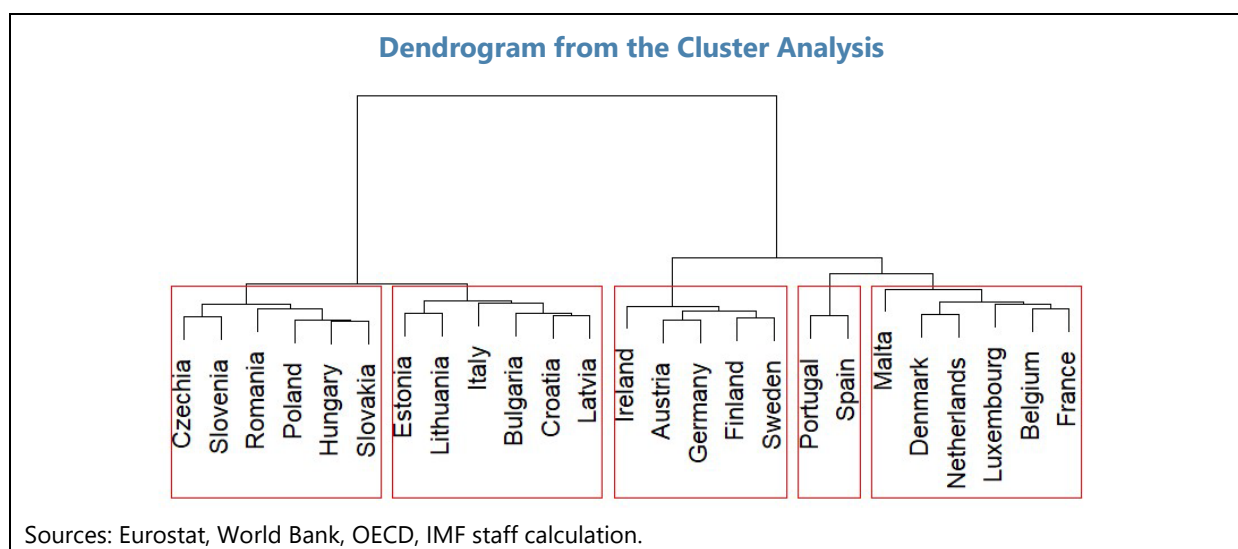
**6. Although there is some variability across models, they generally all indicate high contribution of road infrastructure, real wages, and rule of law to the explanation of GVC participation.** Meanwhile, internet connectivity and the share of population with higher education are typically lower ranking features. Additionally, their impact on the output variable is less homogeneous across models.



## Appendix III. Results from the Cluster Analysis of the Drivers of GVC Participation

A closer look at the GVC drivers in the EU suggests that there are two categories of economies among the member states. The first group of countries is characterized by large non-price competitiveness advantages, mainly in infrastructure, governance, human capital, innovation, and financial depth. The second group, instead, shows high cost-competitiveness and a higher share of manufacturing in GDP. We confirm this observation within a cluster analysis<sup>1</sup> on our dataset, based on the following (clusters of) GVC correlates:<sup>2</sup>

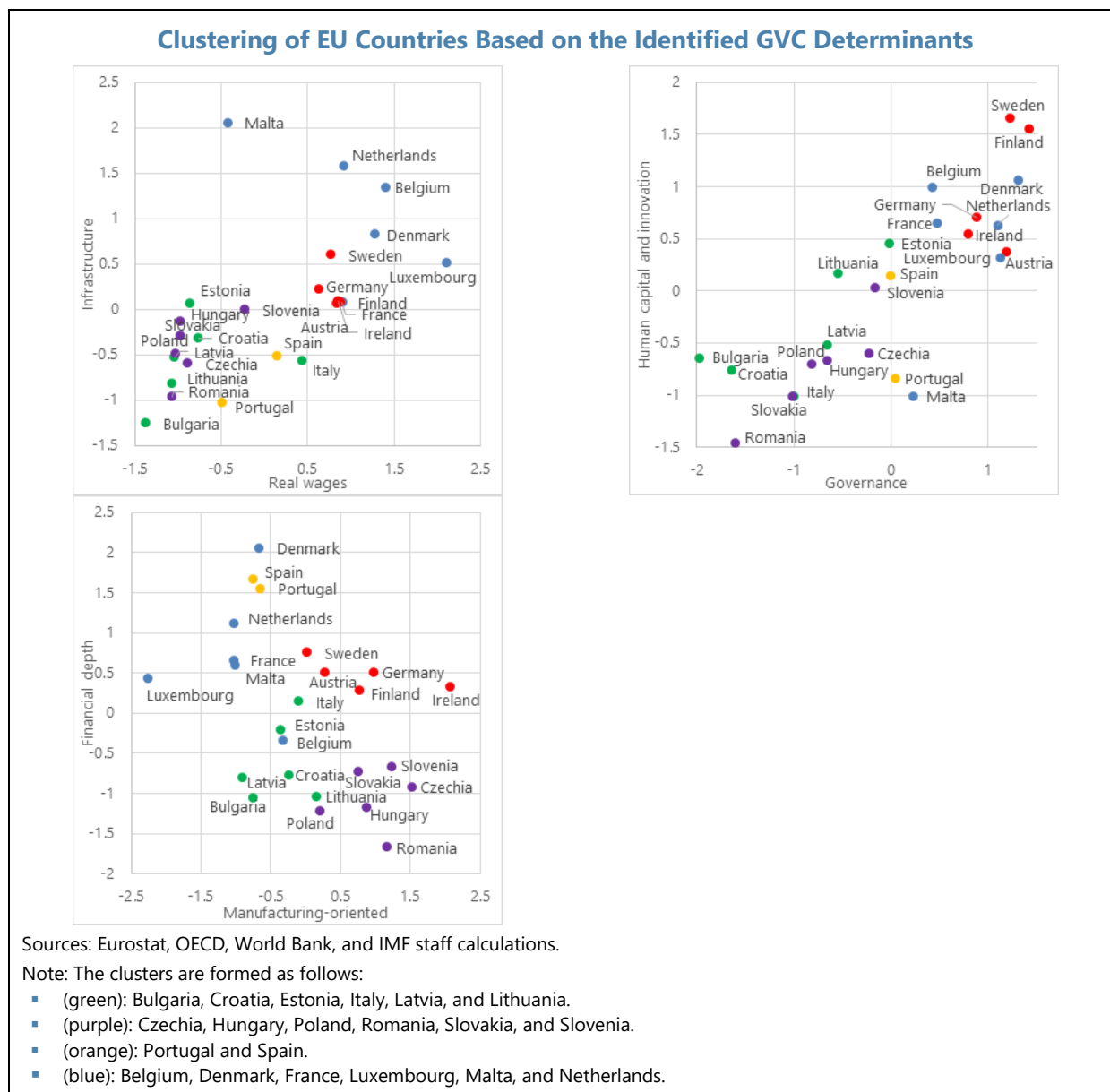
- Infrastructure, calculated as a simple average of road infrastructure and internet connectivity scores of the countries;
  - Cost competitiveness, measured by the real wages;
  - Human capital and innovation, calculated as a simple average from the scores on share of population with higher education and the share of R&D in GDP;
  - Governance, measured by the rule-of-law indicator of the World Bank;
  - Financial depth, measured as the share of private credit in GDP; and,
  - Economic structure, measured as the share of manufacturing in GDP.
- Based on the within group sum of squares, we identify five clusters. Below is a dendrogram, showing the identified five clusters and the hierarchical relationship between different clusters.



<sup>1</sup> We are using Ward's method for hierarchical clustering, which minimizes the total within-cluster variance, based on a chosen measure of distance, in our case Euclidean distance (Ward, 1963).

<sup>2</sup> Average for the 2010–20 period have been used and the data has been preliminarily centralized and standardized.

**1. The figure below shows the clusters in terms of variable pairs.** Each identified cluster is represented in different color. Bulgaria belongs to the green cluster, together with Croatia, Estonia, Italy, Latvia and Lithuania. This group of countries is characterized by low wages and low levels of infrastructure, human capital and innovation, governance, and financial integration, while being relatively manufacturing-oriented. We can see that the green and purple clusters generally share similar GVC drivers except for the level of industrialization – the purple group has a higher share of manufacturing in GDP and somewhat lower level of highly educated population. The blue and red groups are also comparable but can be distinguished based on somewhat more developed infrastructure and lower industrialization in the blue group. Finally, Spain and Portugal form a group of their own, as they are characterized by subpar infrastructure and lower wages, but also by high rule-of-law scores and depth of financial markets.





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