INTERNATIONAL MONETARY FUND

IMF Country Report No. 22/204

PORTUGAL

SELECTED ISSUES

June 2022

This Selected Issues paper on Portugal was prepared by a staff team of the International Monetary Fund. It is based on the information available at the time it was completed on June 7, 2022.

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International Monetary Fund
Washington, D.C.

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June 7, 2022

Approved By
European Department

Prepared By Kamil Dybczak, Lakshita Jain, La-Bhus Fah Jirasavetakul, Magali Pinat, Boyang Sun, Volodymyr Tulin and Jing Zhou

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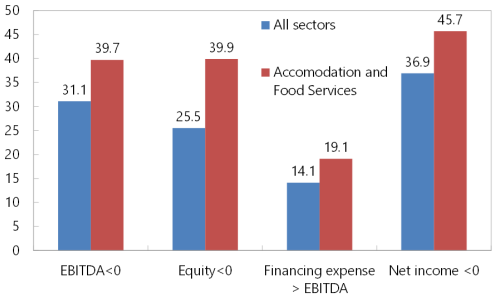
HOW COULD THE COVID-19 PANDEMIC AFFECT FIRM PRODUCTIVITY AND THE SPEED OF THE RECOVERY?[1]

A. Firm Demographics and Corporate Financial Health Indicators: Taking Stock of Actual Data

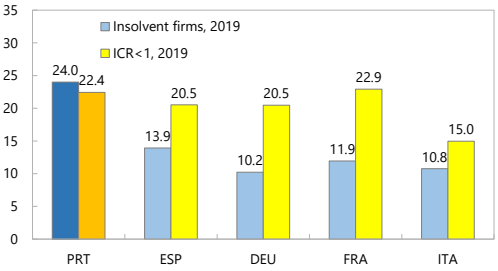
1. Prior to the Covid-19 pandemic crisis, a large share of Portuguese firms already exhibited elevated financial risks. Portuguese corporates were on a deleveraging trend after the European sovereign debt crisis in 2012–13 until the 2020 pandemic. On a consolidated basis, NFC sector's aggregate equity to total liabilities ratio rose from 40 percent in 2011 to 51 percent in 2019, while combined loan and debt security liabilities decreased from 125 percent of GDP in 2012 to 85 percent of GDP in 2019. However, in 2019, some one-third of the firms still did not generate positive net income, a quarter had negative equity (insufficient assets to meet liabilities), and almost one-sixth did not generate enough earnings to cover financing expenses. The risk indicators tended to be weaker in sectors most affected by the pandemic, accommodation and food services in particular. Finally, Portuguese NFCs had relatively weaker financial ratios compared to the euro area (EA) country peers, particularly with regard to share of negative equity firms.

Pre-pandemic Corporate Financial Risk Indicators, 2019
(In percent of firms)



Source: Banco de Portugal.

Vulnerable Firms, 2019
(percent of all firms)



Source: Orbis and IMF staff calculations.
Note: sample limited to firm with data in both 2019 and 2020.

2. In 2020, the share of firms with negative net income and unable to cover financing expenses out of operating revenues surged, although the solvency picture was more nuanced. According to the 2020 data from the Central Balance Sheet Database of Banco de Portugal (BdP), the pandemic-affected sectors saw a sharp increase in the share of financially weak firms.[2] Overall, the share of firms with negative equity rose only marginally, from 25.5 to 26.6 percent. However, firm-level balance sheet data from Orbis, which is used in this analysis, provides a more granular picture at the sectoral level also reflecting the differences in the exit rates of firms between sectors. Specifically, among the firms reporting data for 2020, 6 percent of the firms that had positive equity in 2019 became insolvent in 2020. [3] This transition into insolvency in the three most affected NACE1 sectors rose to about 14 percent from about 6–8 percent in the previous year. Also, the exit rate rose

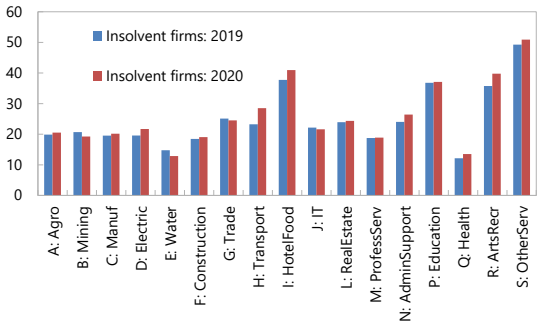
[1] Prepared by Lakshita Jain (University of North Carolina at Chapel Hill) and Volodymyr Tulin (EUR).

[2] Specifically in the accommodation and food service activities, the share of loss-making (i.e., negative net income) firms jumped from an already high of 45½ percent to 67½ percent, the share of firms unable to cover financing expense with operating revenues rose from 19 to 34 percent, and the share of firms with negative equity rose from 40 to 43 percent.

[3] Throughout this paper insolvent signifies negative equity position (shareholder funds) on firm's balance sheet.

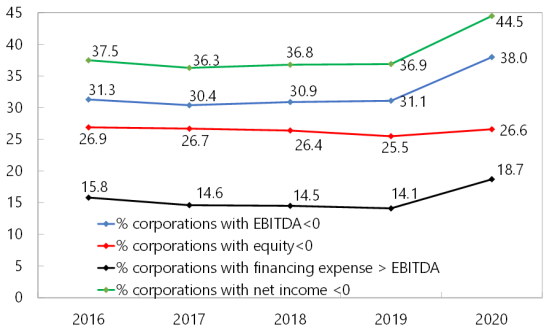
disproportionately more among the previously solvent firms—the share of insolvent firms that exited increased from 13.7 percent in 2019 to 19.6 percent in 2020, while the share of solvent firms that exited increased from 5.7 percent to 11.9 percent. Consequently, the share of insolvent firms among all firms that exited[4] decreased from 44.4 percent in 2019 to 34.9 percent in 2020.

Insolvent Firms: Sectoral Share
(percent, all firms, i.e. not just with data in both 2019 and 2020)



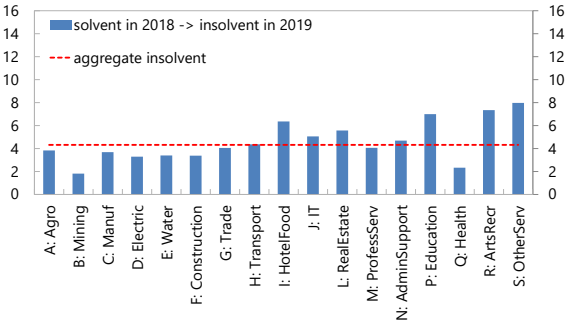
Source: Orbis and IMF staff calculations.

Corporate Financial Risk Indicators, 2016-20
(In percent of firms)



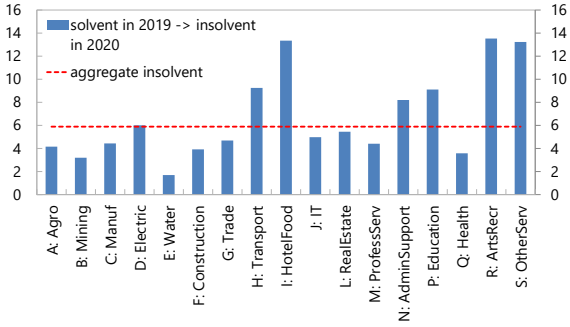
Source: Banco de Portugal.

Share of 2018 Solvent Firms That Turned Insolvent in 2019
(percent)



Source: Source: Orbis and IMF staff calculations.

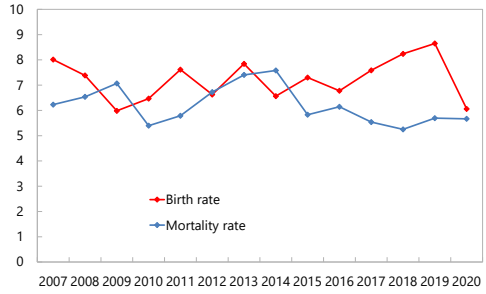
Share of 2019 Solvent Firms That Turned Insolvent in 2020
(percent)



Source: Orbis and IMF staff calculations.

3. On aggregate however, the exit rate was unchanged, while the entry rate dropped sharply. In 2020, the overall exit rate rose from 5.4 percent to 5.7 percent, markedly below the exit rates observed during previous crises. That said, firms' aggregate birth rate saw a sharp decline to the lowest level since 2009.[5] For the affected sectors, while exit rates did not move much, the birth rate fell even more sharply.

NFC's Birth and Death Rates, 2007-2020
(In percent of firms)

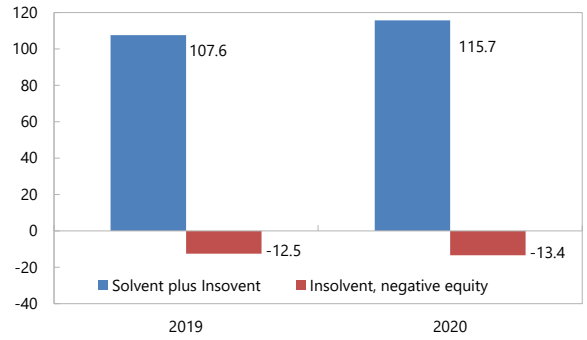


Source: Banco de Portugal.

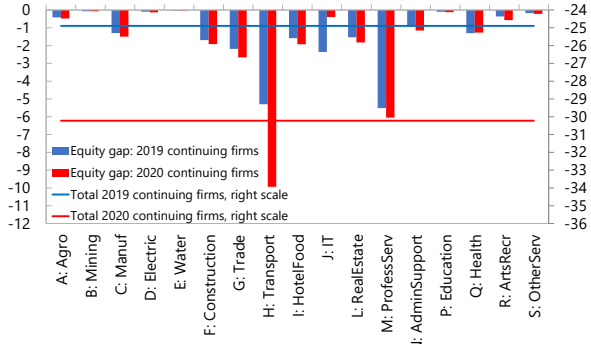
[4] Although lack of 2020 Orbis data reporting does not strictly indicate an exit, aggregate share of firms without 2020 data at 5.9 percent matches well firm closure rates of 5.7 percent in the BdP's Central Balance Sheet Database.

[5] Eurostat data for 2020 indicates a comparable large drop of 24 percent in new business registration and a small increase of about 3 percent in bankruptcy filings compared to 2019. Moreover, bankruptcy filings have been on a downward trend since the 2020:Q1, dropping about 1/4th as of 2022:Q1 relative to the 2019 average. In 2022:Q1, new business registration increased by 22 percent relative to 2019.

4. Overall, pockets of corporate vulnerabilities that emerged in 2020 were masked by improved aggregate NFC balance sheets. Firm level data suggest that the aggregate equity-to-GDP rose in 2020 from about 108 to 116 percent of GDP (equivalent to about 6 billion euros).[6] Nonetheless, the aggregate equity gap of insolvent firms deteriorated by about 1 percent of GDP in 2020, mostly accounted for by the most affected sectors. Moreover, among the firms that reported both 2019 and 2020 data, the aggregate equity gap widened by about 2.3 percent of GDP.[7] Although the equity gaps narrowed in the information technology and professional services sectors, the widening in the affected sectors (excluding transport) was about 0.8 percent of GDP. As elsewhere in Europe, a handful of large and medium-size companies in the transport sector accounted for the lion share of the equity gaps (3 percent of GDP), dwarfing the deterioration in other parts of the economy. Firms with negative equity of about 2½ percent of GDP in 2019 have not reported thus far 2020 data.



Source: Orbis, Haver Analytics, and IMF staff calculations.



Source: Orbis and IMF staff calculations.

5. A large share of Portuguese firms experienced an increase in leverage and the share of leveraged and insolvent firms increased more than in the EA overall. Portugal was relatively harder hit by the pandemic reflecting its reliance on tourism (GDP fall of 8.4 percent in 2020 vs. 6.5 percent in the EA). In turn, Portuguese NFCs were relatively more affected. The leverage ratio decreased (i.e., improved), in 43 percent of Portuguese firms, compared to 50 percent in the EA. As in the EA, leverage increased in about 1/3 of the firms. However, based on the EU definition of an "undertaking in difficulty" (debt-to-equity ratio exceeding 7.5 applied to all firms or technical insolvency), the share of Portuguese continuing firms with financial difficultly rose from 20 to 28 percent, compared to a rise from 14 to 20 percent in the EA.

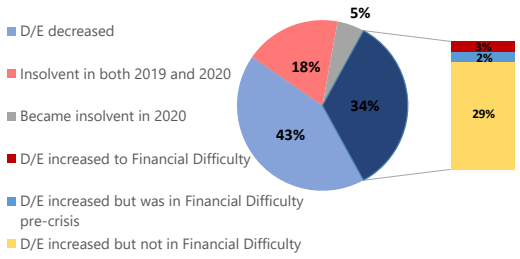
6. The share of Portuguese firms unable to cover interest costs by operational income (EBITDA) also jumped from 22 in 2019 to 33 percent in 2020, again somewhat more than in the rest of the EA. Moreover, about one-third of Portuguese continuing firms that had ICR<1 in 2020 also had ICR<1 in 2019, which suggests that a large share of such firms had a challenging

[6] Simulations for 2021, discussed below, indicate further aggregate balance sheet improvement and further widening of corporate negative equity under the assumptions of no firm exit and no new external equity support which likely overstate the extent of solvency gap deterioration.

[7] The deterioration in aggregate solvency gap is lower primarily due to survivorship bias with non-reporting of 2020 data by firms with solvency gaps in 2019.

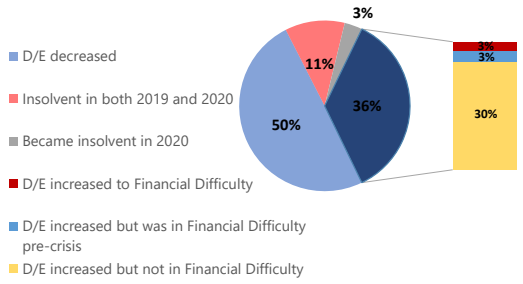
operating income situation even before the pandemic. The share of such firms was also higher in the affected sectors (e.g., 20 percent of the continuing firms in the hotels and food services industry).[8] Moreover, as only about a half of nearly 400 thousand Portuguese firms[9] represented in Orbis reported interest payments in 2019, among the interest paying firms the share of those with ICR<1 may have jumped to nearly two thirds in 2020.

Portugal: Share of Firms by Financial Situation (2020-2019)
(percent of reporting continuing firms, financial diffculty is if debt-to-equity is >7.5)



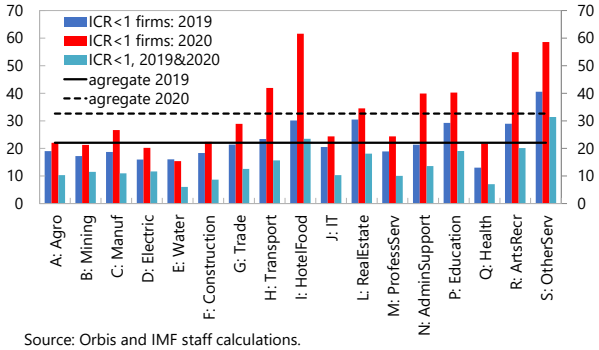
Sources: Orbis and IMF staff calculations.
Note: D/E=debt-to-equity ratio measures as ratio of current and non-current liabilities to shareholder funds.

Euro Area: Share of Firms by Financial Situation (2020-2019)
(percent of reporting continuing firms, financial diffculty is if debt-to-equity is >7.5)



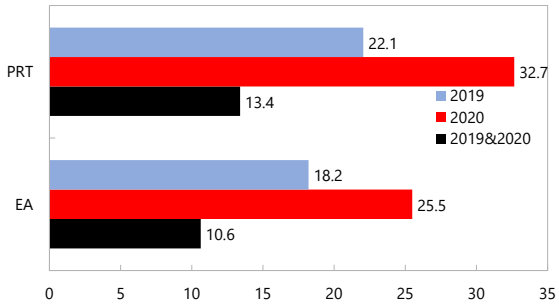
Sources: Orbis

Portugal: ICR<1 Firms
(percent, firms reporting in both 2019 and 2020)



Source: Orbis and IMF staff calculations.
Note: ICR denotes interest coverage ration based on EBITDA

Share of Firms with ICR<1
(percent, only firms with data in both 2019 and 2020 are included)



Source: Orbis and IMF staff calculations.

7. More generally, the NFC sector remains vulnerable to interest rate risks. With nearly 60 percent of NFC loans estimated to be contracted on variable rate with a fixation up to one year[10], an interest rate rise would amplify corporate cash flow pressures. Firm-level simulations of a 100bps increase in borrowing rates, which is in line with widening market-based benchmark such as EURIBOR swaps since 2020, would increase the share of firms with ICR<1 by 2 percentage points.

[8] As reported in the December 2021 Financial Stability Report (Banco de Portugal, 2021a), the financial vulnerability indicator using the proportion of operating income allocated to interest payments in each firm, debt of vulnerable firms in the most affected sectors doubled between 2019 and 2020, while firms that were financial vulnerable in 2020 increased their debt by 30 percent.

[9] Orbis sample covers about 99 percent of NFC turnover (2019, relative to BdP's Central Balance Sheet Database), and 72 percent of employment (2018, relative to OECD Annual Labor Force Statistics),

[10] Based on ECB Risk Assessment Indicator Database.

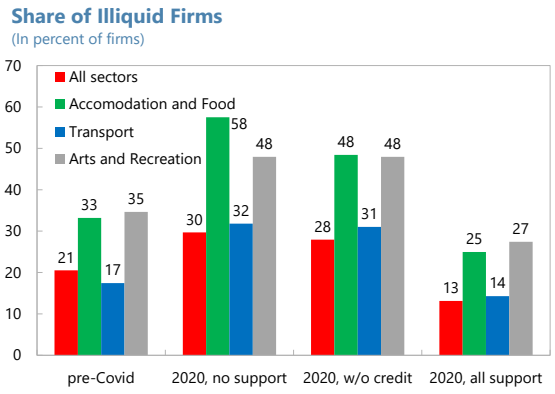
B. Assessing Impact of Liquidity and Solvency Support During the Pandemic

8. To estimate the impact of the pandemic on corporate liquidity and solvency we simulate cash flow and equity positions following the methodology of Ebeke and others (2021). Accordingly, we consider a firm as:

- Illiquid, if its liquidity position is negative at the end of the period.
- Insolvent, if its equity position is negative.

We make several adjustments to the methodology of Ebeke et al (2021). First, we allow firms to partially offset declines in turnover by reducing wage and operating costs, as our focus is on a longer horizon and hence on sustained liquidity shortages rather than the liquidity stress felt during the pandemic. Second, we incorporate the latest policy parameters and turnover outturns on NACE2 level.[11] Third, we distinguish policy uptake by non-distressed and distressed firms, and the liquidity support carry-over into 2021.

9. Credit support measures were key to closing large liquidity shortfalls during the pandemic. Simulations suggest that in the absence of policy support, liquidity strains would have been widespread and especially acute in the most affected sectors. While larger firms were more likely to experience liquidity distress, owing to geared balance sheets, they subsequently are estimated to have benefitted more from policy support. All in all, the share of illiquid firms is smaller post-policies at the end of 2020. Credit measures are estimated to have covered about 6½ percent of GDP out of 8 percent of GDP in crisis-induced liquidity needs (moratoria: 3½ percentage points, credit guarantees: 3percentage points), while job retention programs covered another 2/3 percentage point of GDP. In addition to covering liquidity shortfalls, policies also enhanced NFCs' cash buffers (credit lines: 3 percent of GDP, other measures: 1 percent of GDP). Lastly, the support provided to liquid firms (on 2020 annual basis) is estimated to be relatively small (3/4 percent of GDP), and primarily attributable to employment support schemes. By making access to finance easier, public support measures may also have helped avoid a more abrupt investment adjustment (Banco de Portugal, 2022).[12] These findings, nonetheless, indicate that although universal schemes are effective at bridging systemic liquidity shortfalls, they may come with targeting inefficiencies as firms with positive liquidity also benefitted from public support.

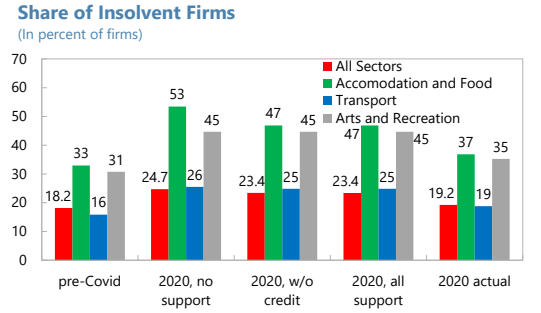


Source: IMF staff estimates.

[11] The turnover assumptions entail recovery to normal time as per responses from Phase 3 of Covid-19 World Bank Enterprise Surveys (February 2021) at NACE1-level adjusted for turnover outrun through mid- 2021. Specifically, the sectoral average recovery time equals 14 months which implies economy-wide recovery to pre-pandemic level by the first quarter of 2022, though with variation

[12] Drop in investment also played a key role in cash flow adjustment. Moreover, the fall in investment was sharper in firms where a greater observed decrease in cash flow from operations (Banco de Portugal, 2022).

10. Nonetheless, policy support closed little of the emerged equity shortfalls, with solvency contributions thus far provided indirectly mainly through job retention and SME turnover loss compensation grants. Our estimates suggest that policies have restored solvency position of around 1½ percent of Portuguese NFCs by the end of 2020, thereby reducing crisis-induced increase in the share of insolvent firms from 6½ to about 5 percent; and by 6 percent of the firms in the accommodation and food sector, thereby reducing the increase in the share of insolvent firms in the sector from 20 to about 14 percentage points. A somewhat lower share of negative equity firms as reported in actual 2020 data (see para. 2) likely reflects unaccounted firm-specific cost-saving factors, and equity injections by the proprietors. Furthermore, the actual data for 2020 corroborates a surge in the share of insolvent firms in the most affected sectors (jumping from about 6–8 percent prior to the pandemic to around 16 percent).



Source: IMF staff estimates.
Note: Reported aggregate pre-covid share of insolvent firms is about 7 percentage points below actual due to (i) lack of data needed for cash flow analysis in micro firms, (ii) downward (survivorship) bias with sample limited to firms reporting in 2020.

C. Outlook Implications: Distress Indicators and Zombification Risks

11. Corporate distress is expected to have remained stable in 2021. Simulations do not indicate further deterioration in the share of insolvent firms among the firms that were both solvent and liquid prior to the crisis and consequently reported data in 2020. The rise in the share of illiquid firms has been relatively small, which reflects the strong policy support. That said, viability considerations played a limited role in the lifeline programs,[13] hence there are risks of an increased share of unviable firms, or those that mask economic and fiscal risks. However, simulations suggest the unwinding of liquidity support may have posed challenges for a small share of firms in 2021 that depleted cash buffers against a still challenging operating environment.[14]

12. Related to the above, corporate zombification has risen. The share of zombie companies with (ICR<1 for three consecutive years and firm's age over 10 year)[15] is estimated to have risen since the start of the pandemic.[16] The definition includes three consecutive years of ICR below 1, and hence

[13] While credit guarantee programs entailed risk mitigating access qualification requirements on the financial situations of a firm, such as positive net position, these requirements were backward looking.

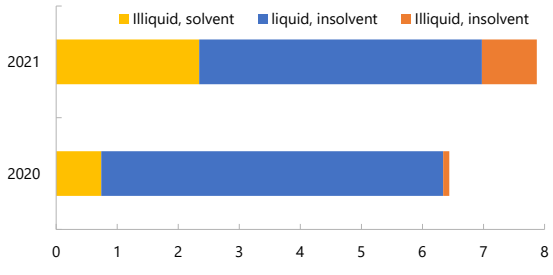
[14] The 2021 balance sheet simulations may likely overstate the corporate distress indicators due to unaccounted cost savings factors or equity injections.

[15] ICR is based on EBIT, given its more common use in literature as measure of operating income. The choice of the profit measure (EBIT vs. EBITDA) affects the calculated ICR and consequently the incidence of zombie firms (EBIT deducts the non-cash expenses related to depreciation and amortization from net profit, whereas EBITDA does not). Although depreciation and amortization are not actual cash outflows, they reduce the value of a company's capital and/or financial assets and thus of its total assets. EBITDA might be suitable for international comparisons given cross-country differences in depreciation or amortization practices, treatment of goodwill or taxation that may distort bottom line comparability. However, EBIT is more suitable for country-specific analysis due to capturing the different effects of depreciation and amortization on companies (or industries) with different capital intensity use.

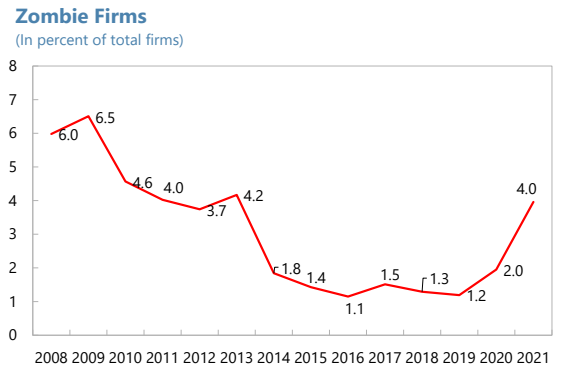
[16] In line with Banco de Portugal (2021a), the results indicate decline in zombification rate since the sovereign debt crisis. For example, also based on McGowan et al. (2018) methodology, BdP reports a share of zombie firms of

(continued)

to be qualified as a zombie in 2021 it requires that a firm had EBIT below its interest bill already before the pandemic. We incorporate actual interest paid by firms in 2020, which among the firms that benefitted from the moratoria may have been temporarily reduced. Recent work by Marques and others (2022) also points to a possible further deterioration of corporate sector health metrics in the near term. Specifically, based on Portuguese firm-level balance sheet simulations, the reduction in the profitability and in the capital ratio of worst-performing firms suggests that heterogeneity in economic recovery may contribute to an increase in corporate insolvency risk, particularly in the most affected sectors. The proportion of firms with negative equity could rise between 2020 and 2023, though to a lesser extent than during the sovereign debt crisis period (2010–2014) and relatively less so on an assets-weighted basis.



Source: IMF staff estimates.
Note: 2020 is based on actual equity; 2021 relies entirely on cash flow simulations.

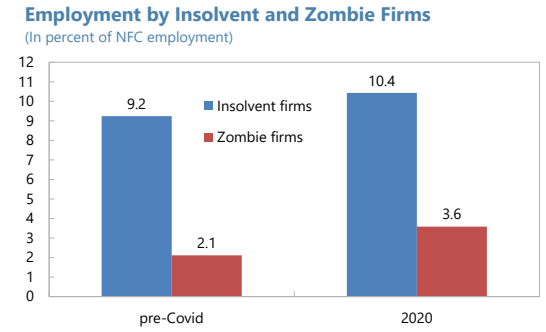


Source: IMF staff estimates.
Note: zombie is defined as ICR<1 for 3 consequtive years and age over 10 years.

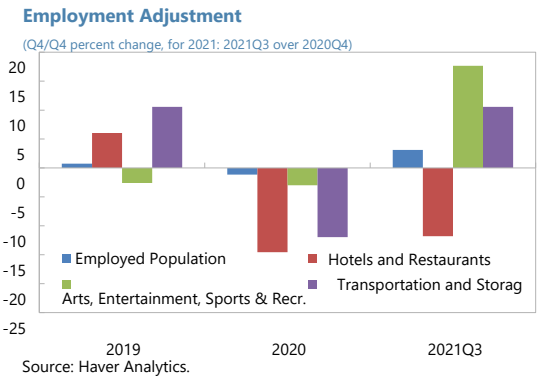
D. Risks: Jobs, Economy, Financial System

13. Policy support prevented a severe impact on jobs and the economy. Without policy support, the crisis could have destroyed up to a third of NFC jobs and 20 percent of economic output. Specifically, in the absence of lifelines support (job retention schemes, tax deferrals, credit) the share of NFCs employment by illiquid firms would have jumped from about 15 percent prior to the pandemic to 33 percent. Similarly, on a value-added weighted basis, the share of economic activity of the illiquid firms would have jumped from 10 to 28 percent. As of 2020, lifeline policies are estimated to have significantly helped illiquid firms even compared to pre-Covid-19. Nonetheless, the share of NFC employment (based on pre-Covid-19 employment figures) in firms that ended 2020 with negative equity or were classified as zombies rose slightly. These have also helped ease labor market adjustment. Although in the absence of actual firm-level employment data for 2020, it is yet not possible to infer the extent of employment adjustment, even though aggregate sectoral labor market data suggest reallocation away from the sectors most affected by the pandemic.

6.9 percent in 2019, a decline of 4 percentage points from the sovereign debt crisis peak, and a somewhat lower incidence based on asset-weighted metric (decline from 7.7 percent to 2.9 percent in 2019). Lower zombification reported in our analysis should reflect greater coverage of micro firms in BdP's Central Balance Sheet Database.

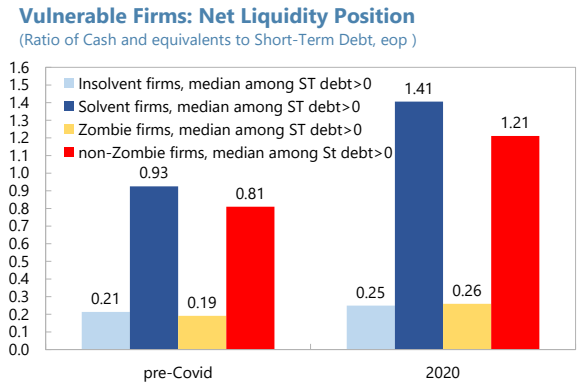


Source: IMF staff estimates.
Note: 2020 is based on pre-Covid employment per firm and actual financials for 2020.



Source: Haver Analytics.

14. Although near-term financial stability concerns are thus far contained, risks could grow over time. Support measures, such as moratorium schemes and state-guaranteed credit lines, have limited the materialization of corporate defaults. Moreover, the share of loans to firms with negative equity is estimated to have fallen from 13.3 percent at the end of 2019 to 12.5 percent by the end of 2020, as growth of total loans to NFCs (9 percent) outpaced growth of loans to insolvent firms (3 percent).[17] At the same time, the share of banking loans to zombie firms has risen from 7 percent pre-Covid-19 to almost 9 percent by the end of 2020 and is likely to have risen to almost 13 percent by the end of 2021 in line with projected increase in the share of zombie firms. Furthermore, both insolvent and zombie firms have significantly increased reliance on short-term debt,[18] and the share of stage 2 loans that benefitted from the moratoria rose from 17 percent in mid-2020 to 32 percent in December 2021, implying risks of higher eventual insolvencies and NPLs. On a positive note, if the recent lower flow of new loans to such zombie firms is sustained, financial stability risks would remain contained.[19]



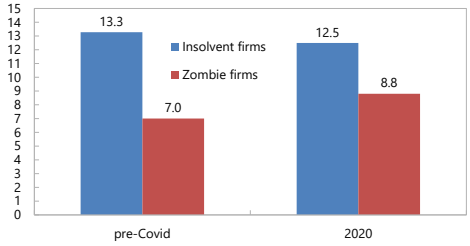
Source: Orbis and IMF staff calculations.

[17] Although credit lines which accounted for about 12 percentage point increase in bank loans did not require solvency, credit growth for such companies appears to have been modest.

[18] The two groups overlap. Specifically, about half of zombie firms are also insolvent, but only a small fraction of insolvent firms (4 percent in 2019 and 6 percent in 2020) are classified as zombies.

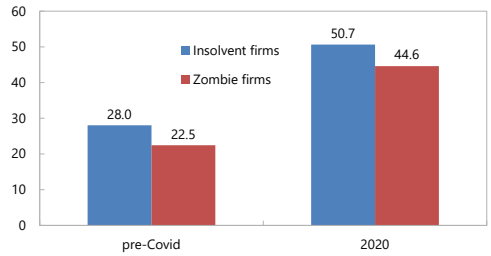
[19] Banco de Portugal (2021a) reports that a relatively low share of new loans (with and without state guarantees) were granted to zombie firms during the pandemic and a greater share of financially weaker firms among those that opted for moratoria, given softer access requirements.

Loans to Insolvent and Zombie Firms
(In percent of total bank loans to NFCs)



Source: IMF staff estimates.
Note: Loans are defined as a sum of long-term and short-term bank debt at the end of the period. 2020 is based on actual exposures and equity as reported in Orbis.

Vulnerable Firms: Share of Short-Term Credit
(In percent of total bank loans to insolvent or zombie firms)



Source: Orbis and IMF staff calculations.
Note: Loans are defined as a sum of long-term and short-term bank debt at the end of the period. 2020 is based on actual exposures and equity as reported in Orbis.

E. Dynamism and Allocative Efficiency: Experience from the Past Crisis

15. The Portuguese experience from previous crises suggests that firm dynamism exerts an overall positive "cleansing effect," though productivity growth differed across firms by size, an effect which may be less prevalent in the current episode. Specifically, while firm dynamism had different overall outcomes during the GFC (2008-12) and EA debt crisis (2013–17) episodes, in both cases, exits contributed to improving total firm productivity. Specifically:

- Exit has been an important productivity raising factor throughout both periods (0.33percentage points and 0.15percentage points gain per year), as exiting firms have been significantly less productive. However, during the GFC crisis exiting micro-firms and large companies as a group were more productive than their continuing counterparts, but not for the SMEs. This finding is in line with those of Carreira and Teixeira (2016), who find that financing factors (credit conditions, sales, operating cash flow, leverage), were important determinants of firm exit during the GFC.

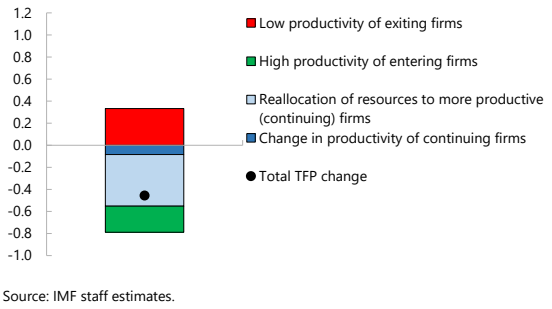
- While aggregate productivity of micro and SME companies declined (0.45 percentage points per year) during the GFC period of 2008–12, it accelerated to about 1.1 percent per year during the 2013–17 period. This is in line with broad-based economic recovery underpinned by structural reform program following the sovereign debt crisis.

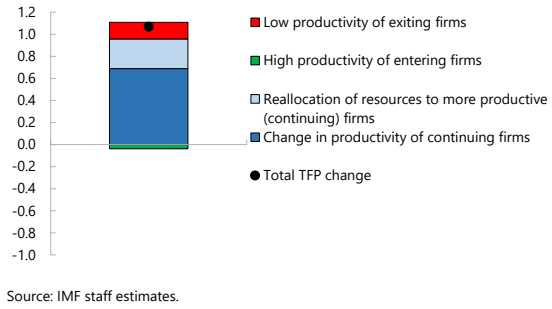
- The impact of entry created a drag on aggregate productivity in both periods. This appears to have been primarily due to compositional factors. Although entrants were more productive within their respective groups, new micro firms tend to less productive than continuing SMEs hence dragging down aggregate contribution of entry.

- In contrast with 2008–12 period, continuing firms contributed almost 1 percentage point per year to TFP growth during 2013–17, of which about two thirds were on account of within firm productivity growth.

- Lastly, the two crises also differed in terms of productivity change among large firms. TFP of large firms was nearly flat during 2008–13, with positive contribution from within firm gains (0.10 percentage points per year) offset by allocative losses (0.13 percentage points per year). In turn, during 2013–17, TFP of large firms grew by almost 3 percentage points per year, with gains on all components, and dominance of allocative efficiency and within firm productivity.

- As regards the current episode, using Portuguese firm-level data survey of firms matched with administrative data, Kozeniauskas and others (2022) find that there has been no rise in exit among lower-productivity firms. This is in line with theory that support policies offset the cleansing effect of recessions. They also find that high-productivity firms have been less likely to take up government support.





16. Qualitatively, the results are comparable for other European countries and the analysis of Portuguese firms' dynamics during the GFC. For example, Patnam (2020) finds a comparable drop in TFP for French SMEs during 2008–12 driven by declines of within firm productivity, which is partly offset by exit and to a much smaller extent by gains from entry and reallocation. In the case of Portugal, Carreira and Texeira (2016) find a negative within-firm effect and a positive effect exerted by resource reallocation and entering firms in Portugal during the 2008–12 crisis. Our results suggest a similar exit dynamic during the GFC, with cleansing exit dynamics dampened by the shutdown of relatively more productive firms among the groups of micro and large enterprises. These results complement the recent Banco de Portugal (2021b) study, focused on within sector employment-weighted productivity and labor reallocation channel,[20] by allowing across-sector and multi-factor reallocation dynamics.

17. The productivity drag from continuing firms with high debt exerts a sizable additional drag on aggregate productivity.[21, 22] The primary channel of zombie's drag on productivity growth comes from allocative efficiency losses.

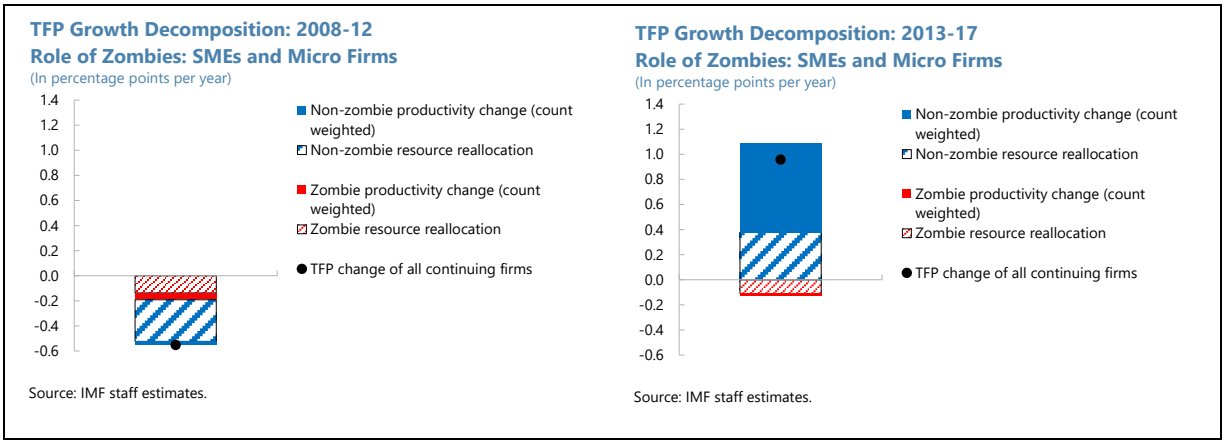
[20] BdP's result indicate that reduced employment share of firms with higher productivity and the less favorable evolution of the productivity of firms with a higher employment share have had a highly negative impact on this reallocation channel within industries.

[21] The results qualitatively are robust to alternative zombie classification, such as a higher ICR threshold of 1.5 and potential industry-specific heterogeneity via an additional zombie requirement of having an above median leverage. The preference for 10-year age is more conservative to 5-year on firm maturity grounds. For example, the 5-year age threshold is the age limit defined by the OECD for young high-growth firms, while most studies point out that firms achieve the mature state somewhere between the sixth and tenth year of existence (Carreira & Teixeira, 2011). Carreira and Teixeira (2021) also suggest that there are no major changes to Portuguese firm zombie classification using 5- or 10-year age limit.

[22] Zombies are less productive and employ more people. Among the SMEs, the average employment was 29 people compared to 22 among the non-zombie firms. Although aggregate SME productivity differential stood at close to 10 percent, zombies tend to be some 20 to 40 percent less productive within their respective industries.

- **In the 2008–12 period**, the total incumbent firms' productivity loss of 0.49 percentage points can be decomposed into loss of productivity of 0.28 from non-zombie firms, and 0.21 percentage points among the zombies. The latter implies a material drag on aggregate productivity, given that zombie enterprises represent only about 6 percent of total. Moreover, non-zombie productivity change has been mostly on account of resource allocation losses. Furthermore, the positive non-zombie within firm productivity change is attributed to micro firms even though within firm change is negative for non-zombie SMEs. This may suggest that in addition to overall allocative efficiency challenges during the GFC, larger SMEs faced further internal adjustment difficulties, likely in view of the prominent past labor market and insolvency regime rigidities. In contrast, the large non-zombie enterprises were able to contribute positively both via allocation and internal productivity.

- **In the 2013–17 period**, the total incumbent firms' productivity gain of 0.98 percentage points can be decomposed into gain of productivity of 1.31 percentage points from non-zombie firms, and 0.33 percentage points loss among the zombies. While the negative contribution of within firm productivity change among zombies had a negligible impact overall, they posed a material drag of 0.31 percentage points per year through allocative efficiency as they kept resources locked from flowing towards more productive non-zombie firms. Critically, the productivity growth differential between zombies and non-zombies had been substantial during this period.



18. The results mirror evidence on debt overhang issues in the European context and pose critical implications for corporate solvency policy. For instance, Duval and others (2020) show that firms with weaker balance sheets experienced a highly persistent decline in post-crisis productivity growth accounting for about one-third of within-firm productivity slowdown. Moreover, firms with higher leverage reduce investment more (Kalemli-Oczan et al. 2018, Demmou et. al, 2020). Overall, comparing the two crisis episodes reveals that zombie firm chip away at aggregate productivity irrespective of the performance of non-zombie incumbents and congest reallocation. Moreover, the productivity gains during 2013–17 period which saw a TFP recovery suggest that most of the gains come from the continuing non-zombie firms as well cleansing Schumpeterian effects of entry and exit.

19. The rise in the share of zombie firms could chip away at aggregate TFP growth 0.2–0.4 percentage points per year over the medium-term. As indicated in the previous section, the share of zombie is estimated to have risen by nearly 3 percentage points. Based on estimates of

the productivity drag from zombies during the past two crises, the allocative efficiency and productivity losses prevalent among zombie firms could chip away at aggregate TFP growth 0.2–0.4 percentage points per year over the medium-term.

F. Policy Conclusions

20. The pandemic eroded equity positions of Portuguese firms with varying impacts across firms' size and sectors. Although the economy-wide share of negative equity firms has risen only marginally (2 percentage points), the share of pre-Covid-19 solvent firms that turned insolvent by the end of 2020 surged in the affected sectors. Moreover, shares of firms with negative net income and unable to cover financing expenses out of operating revenues also increased.

21. The authorities' swift policy response went a long way in addressing immediate liquidity shortages. Liquidity support, primarily via moratoria and credit lines, provided firms with sufficient liquidity buffer. Support to solvency has, however, been small thus far. Notwithstanding targeting of support thus far, SMEs and micro enterprises remain vulnerable, while over a third of companies in the affected sectors, such as food and hospitality and arts and recreation, are technically insolvent.

22. The pandemic, however, has left a large share of Portuguese corporates with a debt overhang and at risk of insolvency. Our estimates suggest that the share of zombie firms has risen from about 1 percent prior to the pandemic to 4 percent. The solvency picture is more nuanced as pockets of corporate vulnerabilities that emerged in 2020 have been masked by improved aggregate NFC balance sheets. Nonetheless, among the firms that reported both 2019 and 2020 data, the aggregate equity gap widened by about 2.3 percent of GDP. Firms that were insolvent or were classified as zombies by end of 2020 saw doubling of the ratio of their short-term to total loan liabilities, from about a quarter pre-Covid-19 to almost a half. For the affected sectors, this risk could be higher, especially if the economic recovery falters or the most affected sectors remain under pressure. Additional vulnerabilities due to the war in Ukraine, cost-push pressures, supply-chain disruptions and higher interest rate could elevate insolvency risks.

23. Although targeted support, via debt-equity swaps and capital injections, to the transport-related SOEs have helped with large solvency gaps, enhanced governance and viability considerations will be key to reducing fiscal risks. State capital injections into main transport SOE (the Lisbon and Porto subways or the national rail network) amounted to 1 percent of GDP in both 2020 and 2021 with support to the national airlines, including under the restructuring plan, is expected to be close to 3 percent of GDP. The pandemic has compounded pre-existing risks to the financial sustainability of these companies, and it is critical that efforts to revitalize balance sheet are complemented by measures to address governance challenges.

24. The Banco Portuguese de Fomento managed recapitalization scheme—Strategic Recapitalization and Consolidar Programs—have many promising features but may need (size and instrument) augmentation and enhanced incentive structures. The Consolidar program offers new venues for tapping expertise and capital of private institutions (venture capital and equity funds in the case of Consolidar), although the envelope may require augmentation in view of relatively large equity shortfall among affected SMEs and uncertainties surrounding the tourism

recovery. Program flexibility is critical, and a quantitative evaluation desirable as new information about take-up rates, implementation challenges, the strength of economic recovery, and the ability of the program to stabilize firms becomes available.

25. Broad-based economic recovery underpinned by structural reforms would help spur firm dynamism, productivity growth, and strengthen financial health metrics. Continued strong growth would bolster the operational environment across the spectrum and help reduce balance sheets vulnerabilities. Nonetheless, past crisis recoveries reveal that zombie firms chip away at aggregate productivity, irrespective of the performance of non-zombie incumbents, thereby congesting reallocation. Strong restructuring and insolvency regimes would facilitate effective reorganization and exit of business and optimizing resource reallocation without overwhelming the financial system.

Annex I. Technical Notes

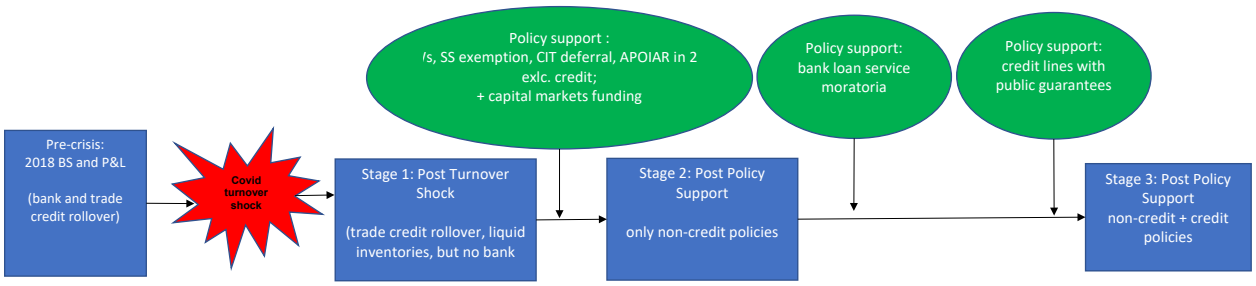
Balance Sheet Simulations—Technical Notes

Liquidity position is simulated according to:

$$Cash_t = CashFlow_t + LiquidAssets_t - MaturingLiabilities_t - Dividend_t + NewCredit_t - \\ -Interest_t NewCredit_t \quad (2)$$

$$CashFlow_t = (1-\beta_j)(Sales_t - MaterialCost_t) - (1-\gamma_j)Wages_t - OtherOperatingCosts_t + \\ (FinRevenue_t - FinExpense_t) - InterestExpence_t - Taxes_t \quad (3)$$

Where β_j is industry-specific turnover shock, and γ_j is the extent of industry-specific wage bill adjustment. The turnover shock reduces operational cash-flows of firms in sector j through a decline in sales. Firms are also able to adjust material costs in the same proportion as the change in turnover, but the extent of employment adjustment varies according to γ_j. Compared to the methodology of Ebeke et al (2021), we effectively allow firms to partially offset declines in turnover via reducing wage costs. Underlying to this difference is focus on a longer horizon and hence sustained liquidity shortages rather than the extent of liquidity stress felt during the acute stage of the first several months of the pandemic. Firms need to meet obligations on fixed costs, financial payments, and corporate taxes. On the revenue side, they receive financial revenue from financial investments. Hence, we assume that firms continue to generate cash flows via sales as opposed to receivables, while they also face cash outflow through purchase of supplies rather than trade payables. Lastly, we impose several stages of the cash flow dynamics (Figure), in order to distinguish firm's use of policy support, such as credit moratoria, consequent use of credit lines, as well as impact of tax payment liabilities or tax loss carry-over in the outer years.



Equity position is then calculated according to:

$$Equity_t = Equity_{t-1} + CashFlow_t - Amortization_t - Interest_t NewCredit_t + SolvencyBoost_t \quad (4)$$

Where $SolvencyBoost_t$ denotes solvency support element associated with non-refundable lifeline policy support, which de facto is limited to (i) job retention and wage subsidy schemes including corresponding social security contribution exemptions, and (ii) SME grant provided under APOIAR.PT. All other policies are considered to only affect liquidity (Table 1).

Table 1. Key Policy Support Measures

	2020		2021	
	size, % GDP	impact	size, % GDP	impact
Job retention schemes (STW, progressive recovery, wage subsidy)	0.7	L, S	0.5	L, S
Social security contribution exemption	0.25	L, S	0.1	L, S
SME grants (turnover loss compensation)	…		0.5	L, S
Policies with solvency support:	**0.95**		**1.1**	
Corporate tax deferral	0.3	L	…	L
Bank loan service moratoria, NFCs *	3.5	L	2.5-4.0	L
Loan guarantee schemes **	4.5	L	0.5	L
liquidity support policy total:	**8.3**		**3-4.5**	

Note: Policy impact: L=Liquidity support, S = solvency support
* estimate of debt service affected by moratoria based on eligibility and liquidity shortfall (non-precautionary). No corresponding figures of debt service are officially reported.
* for 2021, estimate of uptake is lower than the envelope.

The 2021 forecast incorporates NACE1-level recovery to normal time responses from Phase 3 of Covid-19 WB Enterprise Surveys (February 2021), adjusted for turnover outrun through mid-2021. The average recovery time across sectors of economic activity equals 14 months and implies economy-wide recovery to pre-pandemic activity level by the first quarter of 2022, which has been generally in line with the Survey's expectations. Further, wage bill adjustment equals NACE2 employment change. The analysis uses firm-level data on balance sheets and income statement from the Orbis database. The simulation covers about 250 thousand firms operating in Portugal during 2018, taking the latest financial statements available for each firm. Although this represents about a third of registered companies, with micro firms slightly underrepresented, it represents almost 80 percent of total operating revenue of corporates in Portugal. To ensure comparability and representativeness of the results, particularly assessment of the economy-wide liquidity and equity shortfall, we upscale the sample using OECD Structural Demographics and Business Statistics by aggregate turnover at the NACE2 and company size.

Productivity Decomposition—Technical Notes

Changes to aggregate productivity can be decomposed into the firm-specific factors as well as factors related to dynamism of firm entry and exit. Using data on SMEs from ORBIS[1] for estimation, the change of aggregate productivity, measured using the Levinsohn-Petrin (2003) method, is decomposed following Melitz and Polanec (2015):

$$\Delta P_t = \Delta \bar{P}_{Ct} + \Delta cov(\theta_{it}, p_{it}) + \theta_{Et}(P_{Et} - P_{Ct}) + \theta_{Xt}(P_{C(t-\tau)} - P_{X(t-\tau)}) \quad (1)$$

[1] ORBIS data were cleaned following steps that are based on Kalemli-Ozcan et al (2015) and Gopinath et al (2017). Micro firms and SMEs i.e., employing less than 250 persons or annual turnover below 50 mln euro, comprise 99.9 percent of firms in the non-financial sector, and generate 55.8 percent of value added and 64.1 percent of employment. We exclude the following NACE1: Education, Financial and insurance activities, Administrative and support service, Public administration and defense, and Human health and social work activities.

Where P_t represents the aggregate productivity level in year t, and C, E, and X denote the groups of continuing, entering, and exiting firms; θ_{it} and p_{it} is the firm's value-added market share and productivity level, respectively. θ_{Gt} is the share of group G; and P_{Gt} and $\bar{P}_{Gt}$ are correspondingly value-added weighted and unweighted average productivity for each of the groups $G = (C, E, X)$. Correspondingly, the first term captures the contribution of within-firm productivity changes of continuing firms. The second term reflects inter-firm resource reallocation towards more productive continuing firms. The last two terms capture the aggregate productivity contribution of entering and exiting firms, respectively.

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DEVELOPMENTS AND PROSPECTS FOR THE TOURISM SECTOR IN PORTUGAL?[1]

A. Pre-Pandemic View

1. Portugal is among the most tourism reliant countries in Europe. In 2019, the tourism sector accounted for around 15 percent of GDP and 18 percent of employment.[2] Tourism exports represent nearly 20 percent of total exports, significantly more than in other European countries (Figure 1). The indirect impact of the tourism sector on the economy, through linkages with up- and down-stream industries is also sizeable.[3] Using Portugal's input-output tables and the Leontief inverse matrix, a simulation of a one percent shock to tourism-related sectors,[4] which propagates within the same period through these sectors to their direct and indirect suppliers, is estimated to induce about 0.4 percent change in the aggregate output.

2. In line with an increase in global tourism, foreign tourist arrivals in Portugal have been steadily growing since 2000. Tourist arrivals increased by about 1/3 between 2000 and 2010. The trend accelerated after, with the number of international tourists almost doubling between 2010 and 2019. In 2019, Portugal attracted nearly 25m international tourists—about 16 percent of the global total—and was the 15th most visited country in the world.[5] Tourism exports rose from 15 percent of total exports in 2014 to 19 percent in 2018, significantly contributing to Portugal's recovery from the global financial and EA sovereign debt crises. This increase reflected both, improved competitiveness, but also a diversion of tourism from neighboring regions with political instability.[6]

3. The sources of tourist arrivals have also expanded over time. Despite being a destination for primarily European tourists, more recently, Portugal attracted more non-European tourists—especially from the United States and China. While tourism is highly reliant on foreign tourists, domestic tourists have been playing an important role, accounting for almost 30 percent of all tourists in 2019, though traditionally they spend less than international tourists.[7]

[1] Prepared by Kamil Dybczak, La-Bhus Fah Jirasavetakul, Boyang Sun, and Jing Zhou (all EUR).

[2] Total contribution by the tourism sector is defined as the GDP generated directly by travel and tourism sector plus its indirect and induced impacts.

[3] For example, a purchase of intermediary goods and services produced by industries supplying the tourism sector.

[4] The tourism-related sectors include the following NACE categories: Transportation and storage (S.24), Other business sector services (S.31), Accommodation and food (S.25), Arts, entertainment (S.35).

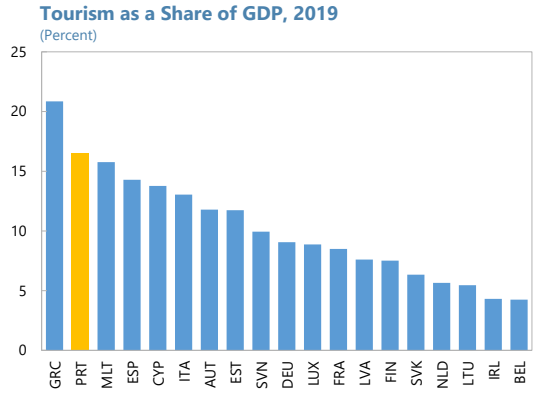
[5] UNWTO Barometer, July 2021.

[6] Banco de Portugal, December 2018 - Tourism exports: recent developments and future prospects.

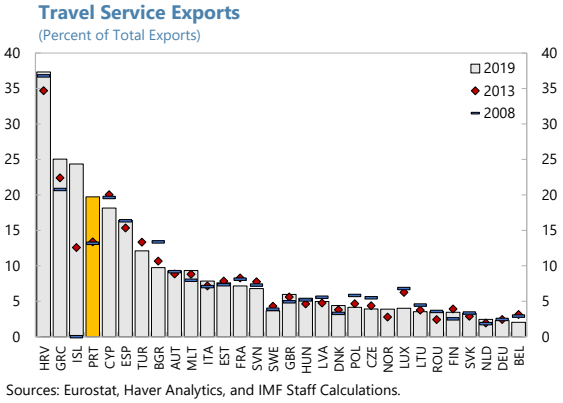
[7] The non-resident component determines two-thirds of the GVA of tourism and is expected to continue to be the main tourism determinant (Banco de Portugal, October 2020).

Figure 1. Macroeconomic Relevance of the Tourism Sector in Portugal

Tourism is a sizable share of GDP…

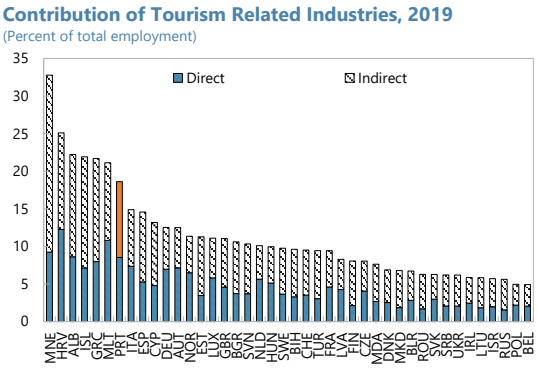


and foreign exchange earnings…



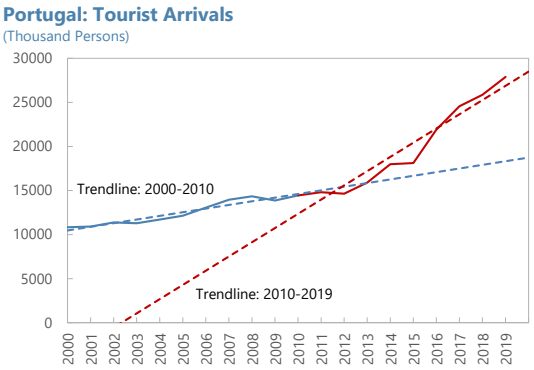
Sources: Eurostat, Haver Analytics, and IMF Staff Calculations.

due to tourism's direct and indirect economic linkages.



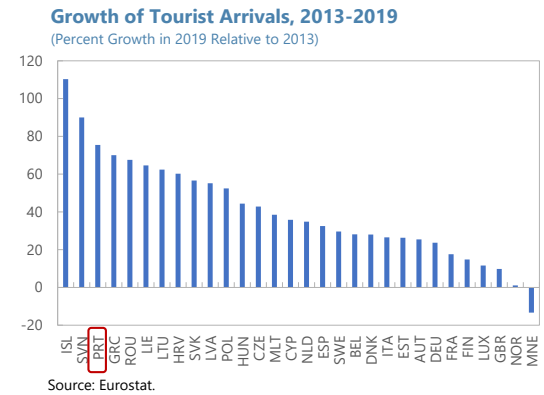
Sources: World Travel and Tourism Council and IMF staff calculations.

The sector accelerated in growth over the past decade…



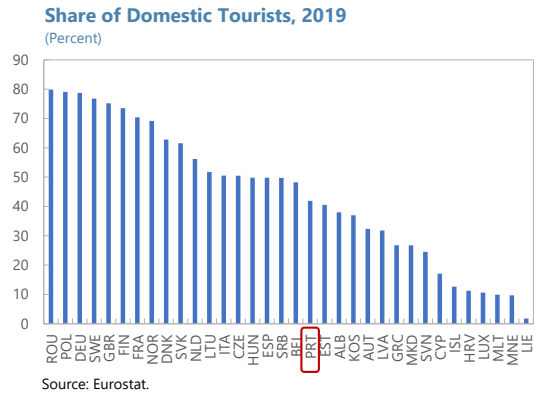
Source: Eurostat.

…generating one of the fastest growth in tourist arrivals in the region



Source: Eurostat.

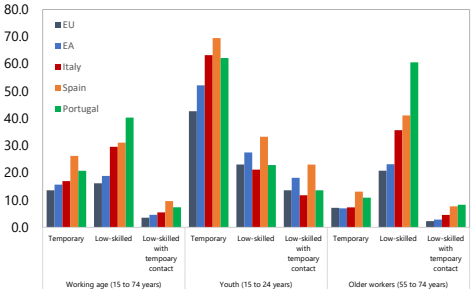
That said, domestic tourists also represent a sizable share of total tourist arrivals.



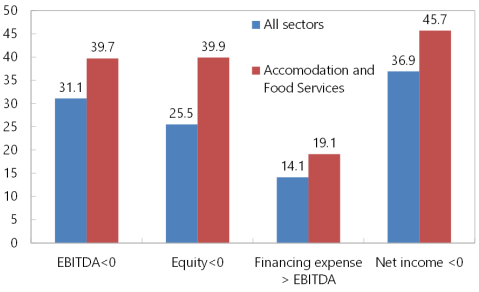
Source: Eurostat.

4. However, despite its recent success, the tourism sector faced some important challenges even before the pandemic. The sector is disproportionately represented by small and micro firms that are typically more vulnerable to economic shocks. These firms account for close to 90 percent of all firms in the tourism sector and at least one-fifth of the total turnover. Relatedly, the sector hires a larger share of low-skilled workers and those with temporary contracts. As a result, productivity levels in this sector are lower compared to the rest of the economy. Partly reflecting these factors, firms in the tourism sector entered the crisis with weaker balance sheets compared to the rest of the NFC. Also, the disproportionate effect of the Covid-19 shock on this sector has imposed greater balance-sheet strains (Selected Issues Paper I) and related hardships on their workers, exacerbating distributional challenges of the crisis.

Workers Characteristics by Age Groups
(Percentage of employees)



Pre-pandemic Corporate Financial Risk Indicators, 2019
(In percent of firms)



Source: Banco de Portugal.

B. The Effects of the Pandemic on Tourism[8]

5. Global travel restrictions and travel hesitancy severely impacted tourism since the outbreak of the pandemic in early 2020 (Figure 2). High reliance on air travel and an unprecedented collapse in tourist demand from Portugal's major markets, e.g., Spain, the United Kingdom, France, and Germany resulted in nearly halted international travel to Portugal in April and May 2020.[9, 10] Tourism improved slightly upon reopening of the economy in early summer but declined again with a resurgence of the virus in late summer that led to stricter restrictions. Overall, international tourist arrivals and tourism-related exports fell by 60 percent in 2020 compared to 2019. Global tourism suffered another setback at the beginning of 2021 as countries tightened travel restrictions and imposed mandatory quarantines in response to new virus strains. Overall, in 2021, international arrivals to Portugal were 45 percent below 2019 levels and GVA in tourism-related activities some 12 percent below the 2019 level (compared to total GDP about 4 percentage lower than the 2019 level).[11]

[8] The analysis in this Selected Issues Paper pre-dates Russia's invasion of Ukraine and does not include additional considerations of potentially negative spillovers from the war in Ukraine on tourism prospects.

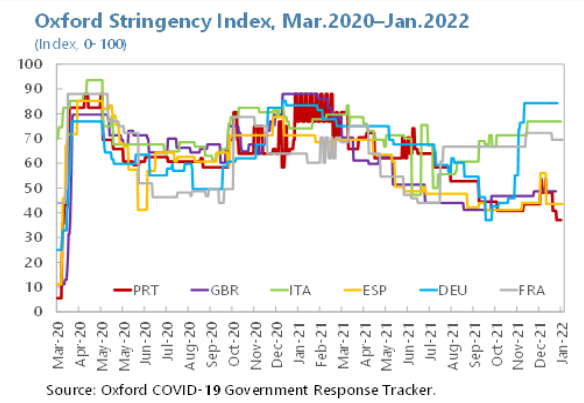
[9] See Banco de Portugal (October 2020) "The impact of the pandemic on the tourism sector" for further details.

[10] Milesi Ferretti (2021) shows how the deviation of 2020 growth from its pre-Covid-19 forecast correlates with the share of tourism in GDP and concludes that tourism-dependent economies suffered a more severe shock.

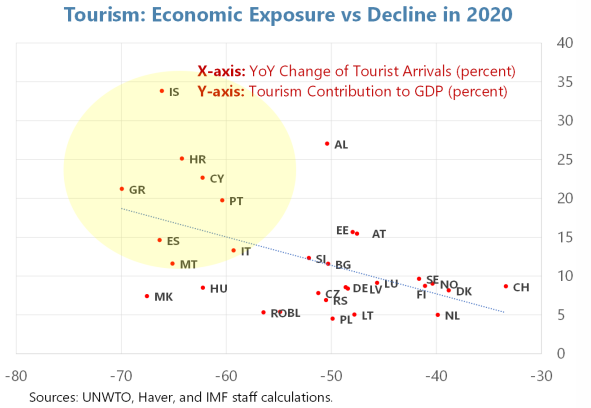
[11] Using the results of the Fast and Exceptional Enterprise Survey – Covid-19 (COVID-IREE), Manteu et al. (2020) analyze the short-term economic impact of the pandemic on economic sectors and the role support measures adopted by the authorities. The authors find out that accommodation and food services stand out as the most affected sector.

Figure 2. Impact of Covid-19 Pandemic

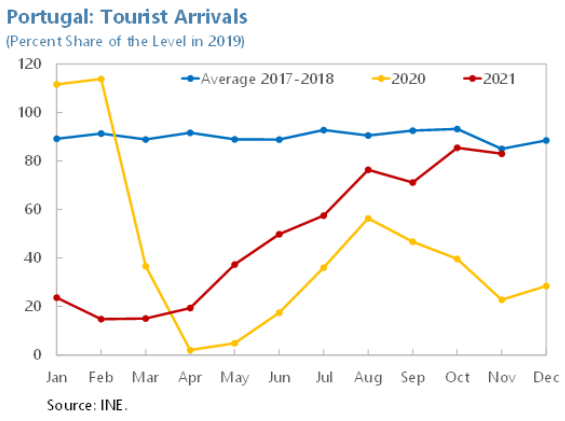
The virus induced start-stop lockdown measures in Portugal and it's tourism source countries.



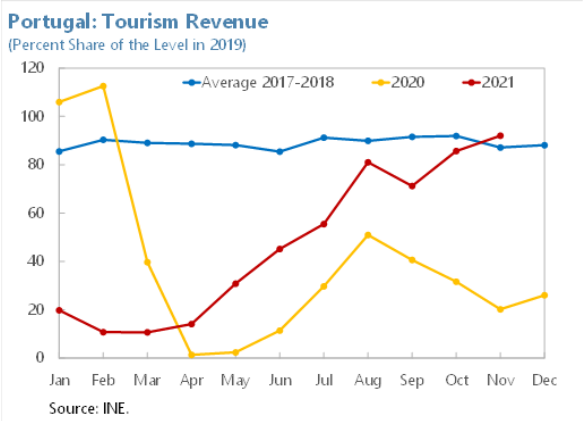
Given its tourism reliance, Portugal was hit harder relatively to its peers…



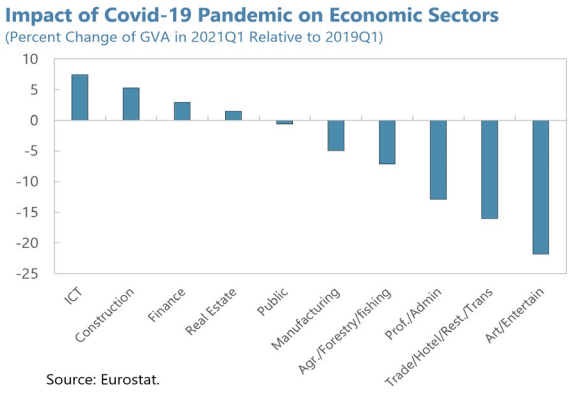
…resulting in a sharp decline in tourist arrivals and…



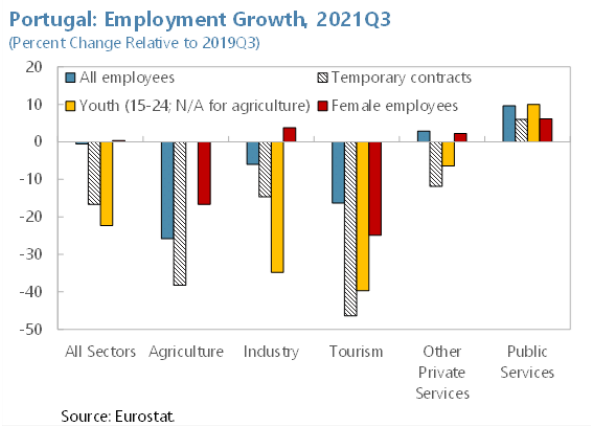
…and related earnings…



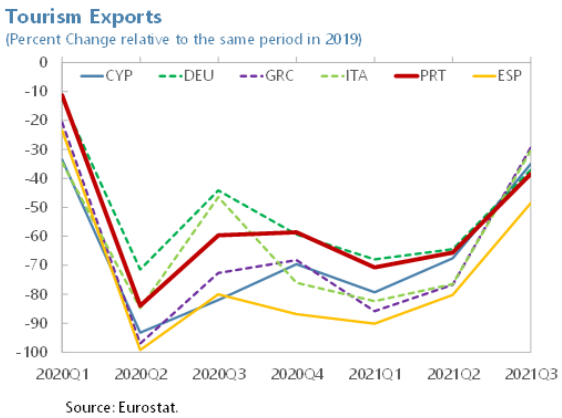
…tourism-related sectors where much harder hit than others



Employment also fell more sharply in tourism, hurting specifically the youth and those with temporary contracts.



6. The wide range of measures to support the tourism sector alleviated some of the pressures on this sector. VAT tax rebate for catering, accommodation and culture supported demand in accommodation and food sectors. Job retention schemes like wage subsidies (for hours not worked) and income tax and social security deferrals to employees, employers, and self-employed protected jobs.[12] Direct support for the small and micro businesses significantly helped in containing the liquidity and, to a limited extent, solvency pressures in this sector. As in other European countries, the government also approved a moratorium on bank loan repayments for hard-hit households and companies affected, which has been extended until end-September 2021. State-guaranteed credit lines were also provided for the hard-hit sectors (e.g., restaurants, travel agencies and tour operators). These measures helped reducing liquidity pressures significantly: the share of employment in illiquid firms in the tourism sector—measured by their employment—declined from 18 percent before the crisis to 16 percent in 2020, i.e., slightly below the pre-pandemic level. This compares with a counterfactual exercise that suggests that without supporting factors, mainly policy support measures, unemployment levels could have risen to 62 percent during the crisis in the absence of the measures (Selected Issues Paper I).



C. What to Expect after the Pandemic?

7. The tourism industry faces an uncertain future given unprecedented uncertainties related to new infection waves, protracted containment measures and subdued travelers' confidence. Conversely, lower travel restrictions, faster global vaccination rates, stronger recovery in Portugal's main tourism-source countries, and introduction of digital identification tools may support consumer confidence and help with the normalization of international travel. Also, domestic tourists in Portugal can provide an additional offset against renewed global travel restrictions. [13]

8. The IMF staff's baseline forecast suggests a gradual recovery of the tourism sector to its 2019 GVA by end 2023.[14] Based on the 2021:Q3 data outturn, GVA in tourism is still some 7.1 percent below the 2019 level compared to total GDP which is only 2.4 percent below 2019 level. Similarly, employment (hours worked) in this sector is 2.5 percent (7.1 percent) below 2019 levels,

[12] Banco de Portugal (October 2020) "The "simplified layoff": impact on firms' liquidity and employment" discusses the role of the policy measures during the pandemic and their impact across economic sectors.

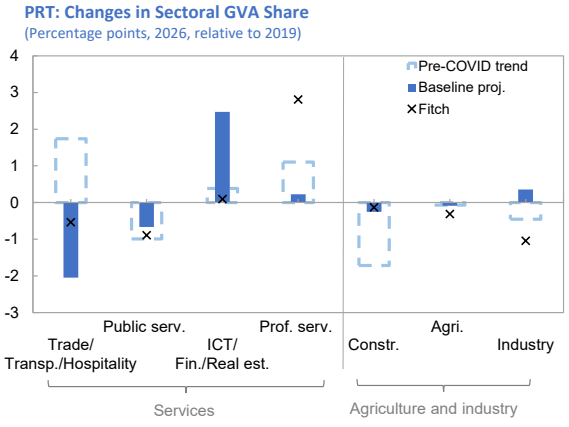
[13] While the share of domestic tourists increased from about 30 percent in 2019 to close to 60 percent in 2020 and 2021, and supported the sector through the pandemic, it is expected to decline to pre-pandemic level in 2022 and 2023.

[14] The forecast of the tourism sector recovery is based on internal model calculations taking into account: (i) vaccination rates in domestic economy and main tourism source countries; (ii) domestic development of the pandemic (number of new cases and tests); (iii) degree of pandemic-related restrictions; and (iv) the profile of tourists (travel preferences, means of transportation, purpose of travel, type of accommodation, etc.). These projections do not have additional assumptions on the effects on tourism due to the war in Ukraine.

compared to 1.0 percent above (2.4 percent below) 2019 levels for total employment (hours worked) implying that the recovery in this sector will lag behind the rest of the economy. If the recovery of the tourism sector is delayed by 3-4 quarters, this would shave off some 0.8 pp from staff's baseline growth projections in 2022 and real GDP in 2023 could be about 1 percent lower than current projected path.

9. Similar to staff forecasts, most international organizations project tourism to recover to its 2019 level only by 2023–2024. According to the World Tourism Barometer (UNWTO, January 2022) international travel will continue resuming slowly in 2022 with a gradual reopening of borders, increased vaccination, and improved travelers' confidence. Under this baseline scenario, international tourist arrivals will rebound mostly in the third quarter of 2022 and reach somewhere between 40 and 60 percent below the 2019 level at the end of the year and reach full recovery only in 2024 or later. Other studies (EUROCONTROL (October 2021), European Travel Commission (2021), Mckinsey (2021)) have reached comparable conclusions assuming tourism to recover in the course of 2023 and 2024.

10. This gradual recovery would imply that the sector could suffer deeper scarring effects, measured by the shortfall in value-added relative to pre-crisis trends. The pandemic is likely to aggravate pre-crisis trends which were already expected to result in significant reallocation of workers across sectors and occupations (IMF 2022), due to factors such as digitalization and automation. A sectoral analysis (see IMF (2021a))[15] suggests that the share of tourism in GVA would have been nearly 2 percentage points higher by 2026 if pre-pandemic trends had continued.[16] Factoring in the impact of the pandemic and advance signals from financial markets, the analysis finds that the share of tourism in GVA would remain below its pre-pandemic level by about two percentage points over the medium-term (blue bar). Assuming the tourism sector recovers faster (e.g. by end 2023 as in staff's baseline forecasts), the share of tourism sector in GVA would still remain below its 2019 level by about ½ percentage point in 2026 (red cross).

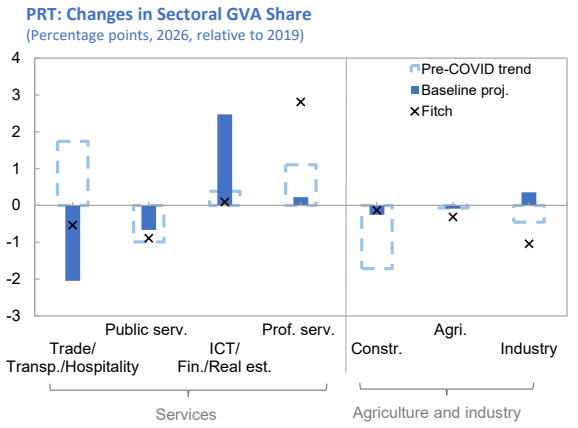


Sources: Fitch; Eurostat; Chapter 3 of Fall 2021 REO; and IMF staff calculations

[15] Annex 3.1. Expected Earnings and Sectoral GVA Growth Projection of the IMF(2021a) describes the methodology used to assess expected earnings and forecast gross value added (GVA) growth at the sectoral level.

[16] During the pre-pandemic period, employment was increasing in the services sector, in particular in accommodation and food services. During the pandemic, employment increased mainly in construction and decreased in industry and services (Banco de Portugal, October 2021 - Sectoral reallocation of employment in the context of the pandemic).

11. The multi-speed sectoral recovery in output will likely be associated with substantial reallocation of labor and other factors of production. Sector-specific estimates of the relationship between output and employment suggest that a sizable share of workers in contact-intensive services would need to be reallocated to other activities. Analysis by IMF (2021a)[17] suggests that—relative to 2019—the share of employment in tourism may drop by almost 1 percentage point over the medium term. These changes to the employment share in a sector are driven by two factors (i) level changes (i.e., growth) of the own sector and other sectors; and (ii) the estimated sectoral output-employment relationship. The reallocation from tourism towards other sectors could be larger if changes in consumer and worker preferences lead to stronger-than-envisaged demand shocks and/or the pandemic accelerates pre-existing trends of automation and digitalization. The reallocation of labor from the tourism sector can be particularly challenging due to the sector's high reliance on the low-skilled and young workers with limited prospects of finding a job in another sector. Conversely, if recent trends in labor reallocation to growing sectors, such as construction is maintained, the strains on the labor market could be much lower (see BdP October 2021 bulletin).



Sources: Fitch; Eurostat; Chapter 3 of Fall 2021 REO; and IMF staff calculations

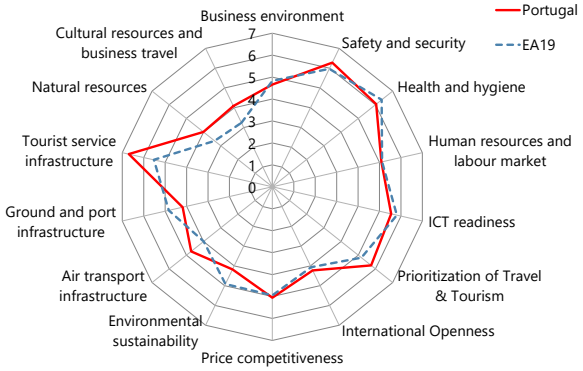
D. Policy Conclusions

12. Given the economic importance of tourism in Portugal, targeted and time-bound support can play a role in shaping the future of the tourism sector. For viable small and micro firms, liquidity-type support, such as guaranteed loans or lending rate subsidies, etc. could mitigate long-term scarring (see also Ebeke and others, 2021). Efficient and timely bankruptcy proceedings for unviable firms would help limit the risk of a rising share of zombie firms while increased access to SME restructuring tools, with possible public support would help to avoid costly bankruptcies. Women, young people, and informal workers are groups that are more likely to be employed in micro or small tourism businesses. To protect the most vulnerable, near-term policy measures should ensure income replacement or wage subsidies as long as the tourism sector remains under stress because of pandemic-induced restrictions. The authorities are implementing many important measures to address these priorities (for example, solvency support programs under Resilience and Capitalization Fund), and it would be important to complete these in a timely manner. Other targeted measures to maintain traveler confidence and limiting uncertainty, such as providing clear information to travelers and businesses on the epidemiological criteria, would also help.

[17] Annex 3.2. Sectoral Employment Projections of the IMF(2021a) describes the methodology used to understand how sectoral employment could evolve in response to the expected divergence in gross value-added growth across sectors and how alternative scenarios for assessing labor reallocation needs are constructed.

13. Medium-term policies need to be focused on further improving productivity and competitiveness. Based on the Travel and Tourism Competitiveness Index (WEF, 2019), Portugal scores among the best European tourist destinations. In terms of tourism sector infrastructure, Portugal ranks 1st globally thanks to exceptional hotel density, high ATM density (4th) and high-quality tourism infrastructure (5th). Portugal has also made progress in diversifying the source markets of tourism by increasing the share of non-EU tourist.

Travel and Tourism Competitiveness Index
(Score, 1-7 (best))



Sources: World Economic Forum; and IMF staff calculations.

Nonetheless, to strengthen the resilience of the tourism economy and ensure its inclusiveness, further improvements will need to focus on environmental sustainability, digital transformation, and productivity of this sector. Active labor market policies and structural reforms to provide incentives for training and education in companies is key to raising skills of workers more generally, including to strengthen their job prospects more generally in the context of potential resource reallocation needs. In this context, the authorities' ambitious investment plans under the NGEU—including in skill building, digitalization and climate sustainability—are important elements to strengthen the resilience of the tourism sector and facilitate reallocation of resources in Portugal.

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REDUCING GREENHOUSE GAS EMISSION IN PORTUGAL: THE ROAD AHEAD[1,2]

A. Portugal and Climate Change

1. Portugal is increasingly vulnerable to natural disasters. Over the last two decades, the frequency of natural disasters in Portugal has increased, with wildfires, droughts, storms, floods, and extreme temperatures becoming the main natural disasters (Figure 1). Between 1980 and 2021, natural disasters affected 166 mil people and incurred damages of USD10 billion.[3] On average, a natural disaster is estimated to have caused damages of about 0.4 percent of GDP and affected 60 per 100,000 inhabitants every year (Table 1). Based on a sample of all natural disasters in Europe between 1980 and 2021, Portugal has a large probability of being hit by a severe natural disaster in the region (Figure 1).[4, 5] Severe natural disasters have a significant negative impact on growth, inequality, fiscal, and trade balances. Climate change also likely had long-term effects on Portugal's tourism and agriculture sectors, including by diverting long-term investment and further constraining fiscal space.[6]

Table 1. Portugal: Natural Disasters in Portugal and Selected Countries

	Natural Disaster (Total) Average per year	Damage (% of GDP) (Percent of GDP) Mean	Max	Population Affected (per 100,000 inhabitants) Mean	Max
Portugal	1.3	0.4	1.3	60	1440
Cyprus	0.4	0.1	0.1	46	238
Greece	2.1	0.6	2.9	74	1074
Spain	2.7	0.0	2.3	262	15437
Italy	3.3	0.0	0.8	7	95
Germany	1.9	0.1	0.6	16	401
France	3.4	0.1	0.8	82	5815

Source: The EM-DAT database and IMF staff calculations

2. Despite its mild weather, energy poverty in Portugal has gradually emerged as an important policy issue and the authorities have recognized addressing energy poverty as one of its key objectives. Natural disasters tend to disproportionately impact the most vulnerable through the loss of economic assets such as roads, housing, schools, or equipment. While the situation has significantly improved over the last two decades, some 20 percent of Portugal's households are still

[1] Prepared by Kamil Dybczak, Magali Pinat, and Boyang Sun (all EUR). The analysis benefited from extensive discussions with Karlygash Zhunussova, and comments and suggestions from Simon Black, Koralai Kirabaeva, Alex Pienkowski, and Ruifeng Zhang and colleagues from Banco de Portugal and the Portuguese Ministry of Environment and Climate Action.

[2] While several 2020 climate indicators became available at the time of producing this note, the analysis mostly uses 2019 data, as some of the 2020 indicators, such as energy consumption or energy imports, were impacted by the pandemic and overall economic slowdown.

[3] Since 1980, Portugal has been hit by 43 disasters, implying the probability of a disaster each year at about 130 percent. Data on frequency of natural disasters, number of affected, and size of damage are from the Emergency Events Database (EM-DAT).

[4] Dongyeol et al. (2018) find that only severe natural disasters have significant economic impact. They define a natural disaster as "severe" if the total damage and the size of population affected is above 90th percentile.

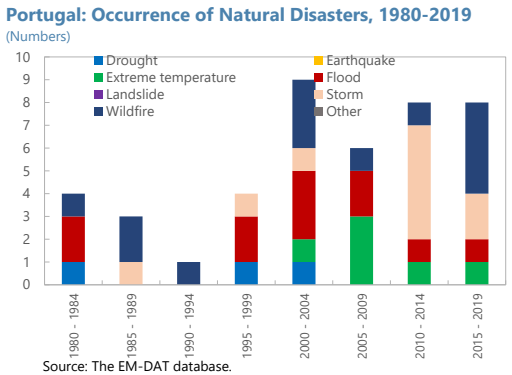
[5] These figures do not consider forward-looking probabilities based on evolution of global and domestic climate change policies.

[6] It is important to recognize however, the challenges in quantifying long-run effects which are sensitive to model specifications and assumptions about prospective policy changes.

unable to properly heat or cool their homes (Figure 1). Other indicators of energy poverty also indicate that Portugal scores below its EU peers. Inadequate insulation of old houses and high electricity prices remain a long-standing issue, although the trend has been reversing recently.[7] Pollution has also become a concern to an increasing share of Portuguese population.[8]

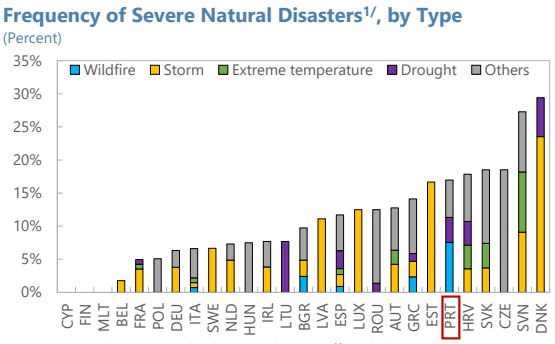
Figure 1. Impact of Climate Change on Portugal

Portugal has been increasingly vulnerable to natural disasters…



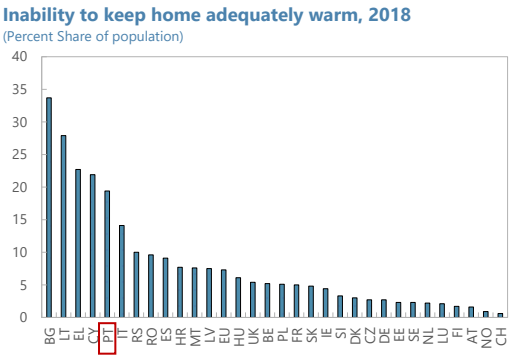
Source: The EM-DAT database.

…with (on average) at least one severe natural disaster happening each year.



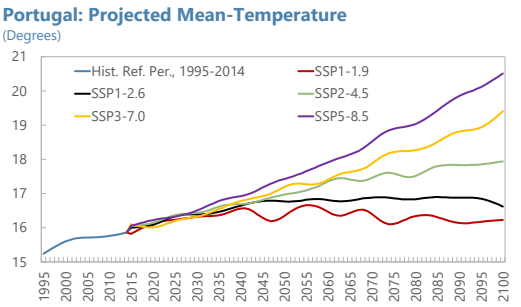
Source: The EM-DAT database, and IMF Staff's calculation.
1/ Severe Disasters are defined by their impact on GDP (larger than the 90th percentile of all the natural disasters in EU27).

The impact of climate change has been felt mostly by the poor…



Source: EC Energy Poverty Advisory Hub.

… and without further action the frequency and intensity of natural disasters is expected to grow.



Source: The World Bank climate dashboard. SSP corresponds to IPCCscenario, from the most optimistic (SSP1-1.9 corresponding to a world where global CO2 emissions are cut to net zero around 2050) to the most pessimistic (SSP5 corresponding to a world where CO2 emissions levels roughly double).

3. Under status quo, the intensity, frequency, and economic costs of extreme weather events are expected to increase (Figure 1). According to the Climate Risk Index, Portugal is among the European countries with the highest potential vulnerability to the impact from the climate change—at 21st place out of 180 countries.[9] Similarly, the United Nations Framework Convention on Climate Change (UNFCCC (2021)) refers to a number of vulnerabilities in case of Portugal, such as increasing frequency and intensity of droughts, floods, flash floods, heat waves, rural fires, erosion,

[7] Adão et al. (2022) quantify measures of heating and cooling needs, pointing at regional differences within Portugal.

[8] Eurobarometer (2021).

[9] According to Ciscar et al. (2014) the geographical distribution of the climate damages is very asymmetric with a clear bias towards the southern European regions, where the welfare losses reach to 3 percent of GDP, i.e., about fifteen times more than in Northern Europe.

reduced annual precipitation combined with higher frequency of heavy precipitation events, and rising sea level. In line with developments in other Southern European countries, additional increase in temperature by one degree Celsius could reduce the value of Portugal's land by about 10 percent, one of the largest in Europe (Van Passel et al., 2017). Under the most pessimistic climate scenario, Portugal could lose more than 60 percent of its land value by 2100 (EEA, 2021).[10]

B. Portugal's GHG Emission

4. With per capita GHG emissions below EU average, Portugal's contribution to global emissions remains limited. At its peak in 2005[11], Portugal produced 69 mil tCO2e (Figure 2), equivalent to 1.8 percent of EU's total GHG and 0.13 percent of world's GHG emissions, ranking 59 out of the top 218 polluting countries. In 2019, Portugal's per capita GHG emissions reached 6.7 tCO2e (EU average 8.4 tCO2e) and continued declining. Nonetheless, the carbon intensity of the Portuguese economy—while also on a declining path—remains above the EU average.[12] The transport sector has been the largest contributor to total emissions, representing almost 30 percent. Agriculture emissions are among the lowest in the EU. One fifth of Portugal's emissions originate from electricity generation. With last coal-based power plant closed in 2021, emissions from electricity generation are expected to decrease significantly in the coming years in part due to the higher reliance on renewable sources of energy and gas. Portugal's energy mix, despite having one of the highest shares of renewables in the EU[13], continues to be dominated by imported fossil fuels.

5. After peaking in 2005, total emissions have decreased close to its 1990 level thanks to energy efficiency improvements and production of renewable energy.[14] GHG emissions rose steadily in the 1990s in line with increasing—partially coal-based—electricity generation and a higher use of cars. Since 2005 however, with greater reliance on natural gas and renewables in electricity generation, and a higher number of more efficient car engines, Portugal's GHG emissions declined significantly, which have been in compliance with the Kyoto Protocol.[15] Improvements in energy efficiency (emissions per unit of GDP) played an important role in reducing emissions.[16] Thanks to these changes, GHG emissions have been on a declining path since 2005—though less over the recent years—while the economy has been growing.

[10] Climate ADAPT provides further information, projections, scenarios and assessment of the impact of climate change, along with an overview of existing pressures and implications for key sectors of Portugal's economy.

[11] GHG emissions peaked in most of European countries around 1990.

[12] Carbon intensity is calculated as a ratio of GHG emissions (gCO2e) per unit of GDP.

[13] Renewable energy production represented 34 percent of total electricity generation in 2020.

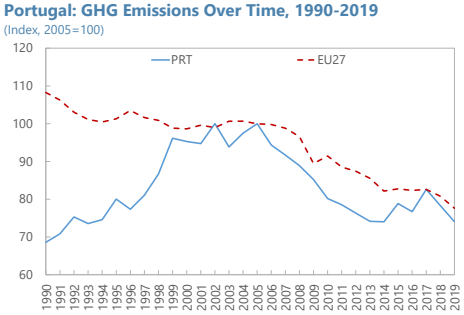
[14] While total GHG emissions in 2020 dropped below 2019 level—driven by lower emissions from the transportation during the Covid-19 pandemic— a rebound in GHG emissions is expected in 2021 in line with the economic recovery.

[15] The steep jump in GHG emissions of 2017 was due to a combination of factors, as low rainfall resulted in a switch from hydro power generation to fossil fuels and contributed to extreme wildfires resulting in a notable increase in GHG emissions.

[16] The decline in Portugal's per capita GDP growth during and after the global financial crisis also contributed to containing emissions.

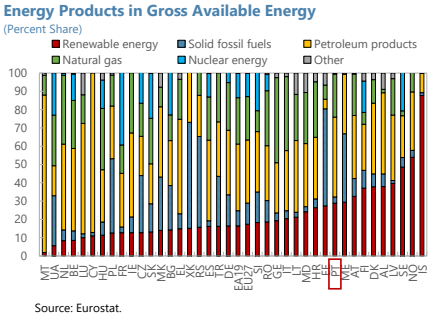
Figure 2. Portugal's GHG Emissions

Portugal's total GHG emissions have been on a declining path since 2005…



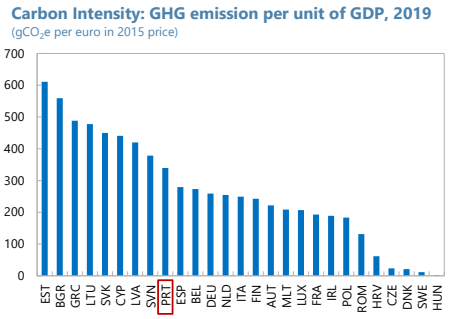
Source: UNFCCC GHG Data Interface.

… However, its energy mix remains dominated by fossil fuels.



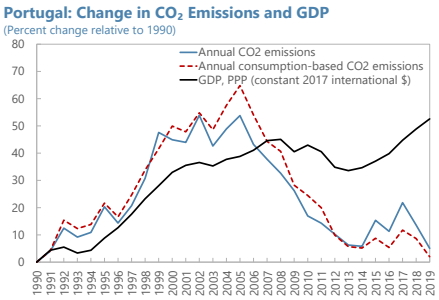
Source: Eurostat.

Carbon intensity is also above EU27 average …



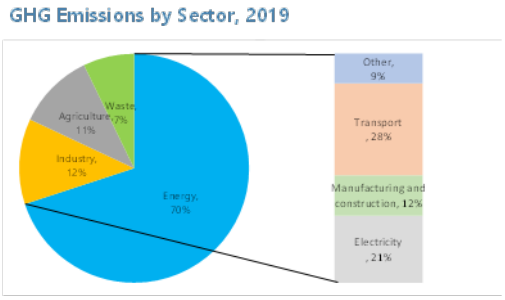
Sources: EEA; Eurostat; and IMF staff calculations.

… but GDP and CO2 emission paths have decoupled in the recent years

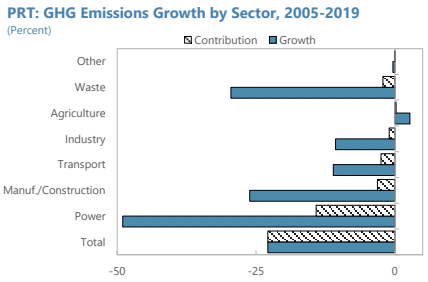


Source: Our World in data.

Transport is the largest domestic emitters…

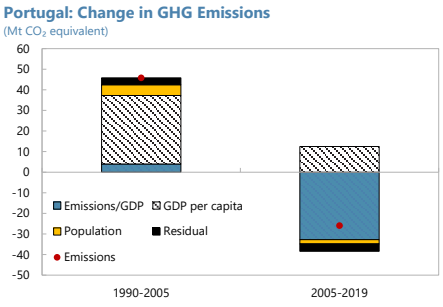


…and, except for agriculture, emissions have fallen across all sectors since 2005.



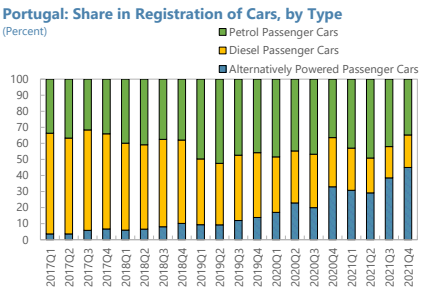
Sources: European Environment Agency (EEA); and IMF Staff Calculations.

The reduction in emissions have been achieved by improved energy efficiency…



Sources: UNFCCC GHG Data Interface; and IMF WEO.

… and partly also due to increasing share of cars using alternative power.



Source: Association des Constructeurs Europeens d'Automobiles.

C. Portugal's Climate Goals and Policies

6. Portugal's vision for low GHG emissions was formulated in the Roadmap for Carbon Neutrality 2050 (RCN) and set out in the National Energy and Climate Plan (NECP).[17] In 2016, Portugal was among the first in the EU to announce its goal of becoming carbon neutral by 2050—five years before EU's requirement. The government announced ambitious national and sectoral targets of reducing GHG by 45-55 percent compared to 2005 in 2030 (Table 2 and 3), reduce Portugal's primary energy consumption by 35 percent and increase the share of energy from renewable sources to 47 percent by 2030 (more than the 32 percent minimum required by the EU). Portugal also committed to ensure that the land use sector, land use change and forestry (LULUCF) would compensate the amounts of CO2 emitted by the different sectors, as set in the Paris agreement and the EU directives.[18] In addition, the authorities committed to increase support for public and private research and innovation on climate change by 3 percent of GDP by 2030 and address the impact of energy transition on vulnerable citizens and energy poverty.

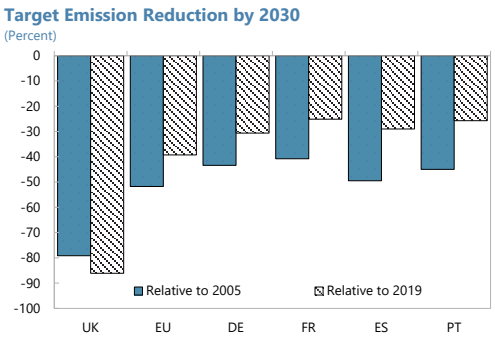
Table 2. Portuguese Strategic Objective for the 2030 Horizon

1. Decarbonise the National Economy
- Ensure a path to reducing national emissions of GHG in all sectors.
- Promote the integration of mitigation targets into sectorial policies.
2. Put Energy Efficiency Dirst
- Reduce the consumption of primary energy in various sectors in a context of sustainability and cost-efficiency.
- Focuse on energy efficiency and the efficient use of resources.
3. Reinforce the Focus on Renewable Energies and Reduce the Country's Energy Dependence
- Reinforce the diversification of energy sources through a growing and sustainable use of endogenous resources.
- Promote electrification of the economy and encourage R&D in clean technologies.
4. Ensure Supply Security
- Diversifying energy sources and origins by reinforcing, modernising and optimising energy infrastructure.
5. Promote Sustainable Mobility
- Decarbonize the transport sector by promoting electric mobility and the use of clean alternative fuels.
6. Promote Sustainable Agriculture and Forestry and Promote Carbon Capture
- Reduce the carbon intensity of agricultural practices and promote effective agro-forestry management.
- Increase the capacity of a natural sink.
7. Develop Innovative and Competitive Industry
- Promote industrial modernisation by focusing on innovation, decarbonisation, digitalisation (industry 4.0) and circular economy.
8. Ensure Fair, Democratic and Cohesive Transition
- Reinforce the role of citizens as active agents in decarbonisation and energy transition.
- Create equitable conditions for everyone, combat energy poverty, create instruments to

Table 3. Portuguese Energy and Climate Targets for 2030

Emissions (without LULUCEF; in relation to 2005)	-45%	to	-55%
Energy Efficiency		35%	
Share of Renewables		47%	
Renewables in Transport		20%	
Electricity Interconnections		15%	

7. Portugal is subject to EU-wide climate directives. Emissions from large companies in the energy, industry, and aviation sectors are covered by the cap-and-trade EU-wide Emission Trading System (ETS). At the EU level, the system specifies the total amount of GHG emissions while allows participants to trade permits. The cap is reduced annually so that EU's emissions is set to reach 43 percent of its 2005 level by 2030. For sectors not covered by the ETS, such as



Sources: Eurostat/UNFCCC, and IMF staff calculations.

[17] The NECPs specifies policies necessary to contribute to EU climate goals and the RCN defines a long-term development strategy to achieve carbon neutrality by 2050.

[18] Some land uses, notably pastures, forests and scrubland, absorb CO2 from the atmosphere. A so-called "carbon sink" is anything that absorbs more carbon from the atmosphere than it releases and thereby lowers the concentration of CO2 in the atmosphere. Examples of natural carbon sinks include vegetation and the ocean. Artificial sequestration includes carbon capture and storage or geological sequestration. Excluding wildfires in 2017, the average carbon sink by forests in Portugal has been about 10 Mt CO2 a year.

transport and housing, a separate emissions trading system is under discussion and expected from 2026.

8. Portugal's Recovery and Resilience Plan (RRP) presents measures that will support decarbonization and energy objectives outlined in the NECP and RNC. Almost a fifth of Portugal's RRP funds (€3.06 bn, 2 percent of 2020 GDP under 16 components of the RRP) have been allocated to Climate Transition pillar although the measures supporting climate change objectives account for 38 percent of the Portugal's plan total allocation. The main projects include investments in (i) sustainable mobility— expansion of the Lisbon and Porto metro systems and the decarbonization of public transportation—(€0.97 billion), (ii) decarbonisation of industry and businesses (€0.75 billion), (iii) promotion of green hydrogen and renewable technologies (€ 0.37billion) and (iii) energy efficiency of residential, public administration, ane commercial buildings (€0.61 billion). The RRP envisages green transition as an opportunity to leverage the Portuguese economy towards sustainability, by promoting technological advancement, job creation, combating energy poverty and preservation of natural resources.

Table 4. Portugal: Carbon Pricing Schemes in Selected European Countries, 2019

Country	Year Introduced	Price, $/CO2 ton	Coverage of GHGs 2018	
			Million Tons	Percent
Carbon Taxes				
Denmark	1992	28	22	40
Finland	1990	73	25	38
France	2014	52	176	37
Ireland	2010	39	31	48
Norway	1991	69	40	63
Portugal	2015	28	21	29
Sweden	1991	137	26	40
Switzerland	2008	101	18	35
Carbon Price Floors				
United Kingdom	2013	25	136	24

Sources: Stavins; World Bank; and IMF Staff calculations.

D. Simulating the Impact of a Carbon Pricing Reform

9. A well-designed carbon price is an essential, although not the only, part of any efficient strategy to reduce GHG emissions. Carbon pricing is deemed to be the most powerful and effective way to reduce GHG emissions (IMF, 2020b). It stimulates improvements in energy efficiency, reduces the demand for energy-intensive products, and promotes green investment and innovation. Furthermore, carbon pricing brings much welcome fiscal revenue, which could finance the greening of the economy and compensate the most vulnerable users for higher energy costs. Carbon pricing can be implemented, for instance, through an explicit carbon tax or through a cap-and-trade system, i.e., EU-ETS.[19]

[19] Carbon pricing can be complemented by incentive schemes that may indirectly affect carbon price such as modifying prices of green financial instruments, incentivizing low-carbon programs and projects, and reducing fossil fuel subsidies.

10. Several measures have already been implemented to appropriately price carbon. The EU's Energy Taxation Directive[20], recommends the reinforcement of carbon taxation and to use the attendant revenue to finance measure to reduce its GHG emissions and to protect the most vulnerable households. About ¾ of Portugal's total GHG emissions are already subject to some form of carbon pricing (Box 1). Almost half of Portuguese companies in the energy and industry sectors participate in the EU-ETS, and an explicit carbon tax for non-ETS sectors was introduced in 2015. Nonetheless, the effective carbon tax remains low relative to estimates of carbon emission damage (Table 4). In addition, revenue from environmental taxes has been on a declining trend—both as a share of GDP and public revenue since 1995—although it increased after the carbon tax was increased in 2015 (Figure 3).

Box 1. Environmentally Related Taxes in Portugal

There are several environmentally related taxes in Portugal, such as: (i) taxes on energy products, (ii) motor vehicles and transport, (iii) waste management, (iv) ozone-depleting substances and others.

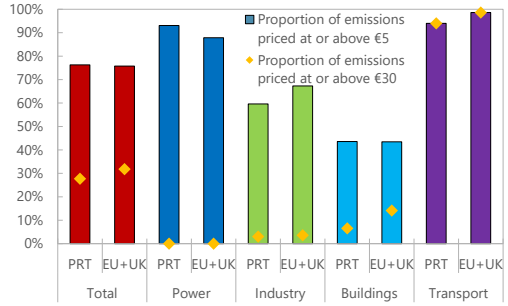
- **Tax on petroleum and energy products (ISP)**, introduced in 1986, is applied on (i) oil, (ii) energy products, and (iii) hydrocarbons—consumed as a fuel—and (iv) electricity covered by Code NC 2716.
- **Add-on to CO2 emissions—carbon tax—**was introduced in 2015 to promote a low-carbon economy, help fight climate change and reduce Portugal's external energy dependency. The tax was designed as an add-on to ISP and applies to sectors not covered by EU ETS. The carbon tax is applied to (i) Petrol; (ii) Oil and colored and marked oil; (iii) Diesel; (iv) LPG (methane and petroleum gases); (v) Natural gas used as a fuel or propellant (vi) Fuel Oil; (vii) Petroleum coke; and (viii) Coal and coke. Carbon tax rate is calculated as the arithmetic mean of the previous year's price from GHG emissions license auctions held under EU ETS. Products exempted from ISP are not subject to the carbon tax.

[20] European Commission (2021).

Figure 3. Portugal: Carbon Pricing, Energy Taxation, and Subsidies

While 75 percent of Portugal's total GHG emissions are covered by some form of carbon pricing…

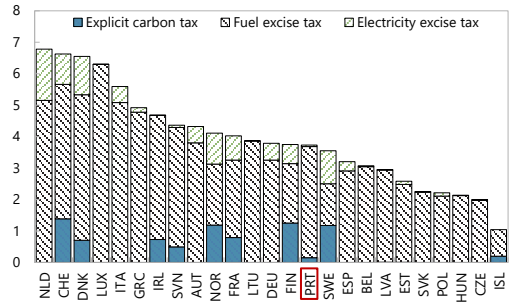
Emission Pricing Coverage, 2015
(Percent of sector total)



Sources: OECD; and IMF staff calculations.

… the explicit carbon tax rate remains marginal …

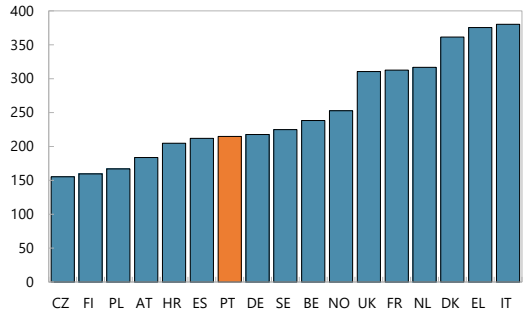
Average Effective Energy Tax Rate, 2019
(Percent)



Source: OECD.

… resulting in an implicit tax rate on energy that is below EU average.

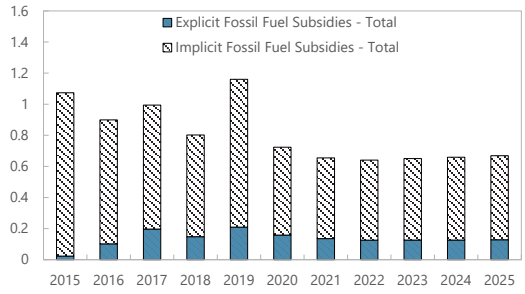
Implicit Tax Rate on Energy
(Euro per tonne of oil equivalent; 2019)



Sources: Eurostat, and IMF staff calculations.

In combination with persistent energy subsidies…

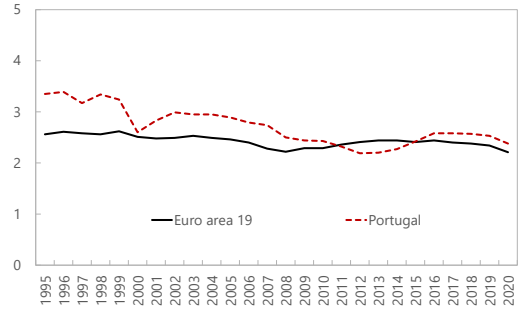
Portugal: Fossil Fuel Subsidies
(Percent of GDP)



Source: IMF Climate Change Dashboard.
Note: Data is projected for the years 2021-2025.

domestic revenue from environmental taxes—as a share of GDP…

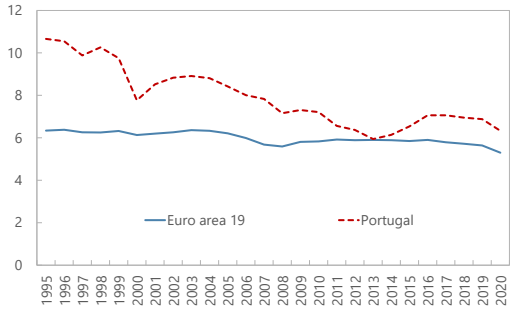
Environmental Taxes
(Percent of GDP)



Source: Eurostat.

… as well as a share of public revenue—have been on a declining path since 1995.

Environmental Taxes
(Percent of total revenues from taxes and social contributions)



Source: Eurostat.

11. The NECP outlines the authorities' plans to further strengthen existing measures. In the energy sector a gradual elimination of fossil fuel subsidies, initiated in 2018, combined with an ongoing revision of tax benefits, is expected to lower incentives to use fossil fuels.[21] The share of companies covered by the ETS is expected to be gradually increased. Revisions of vehicle and road taxes—together with adjustments in other direct and indirect taxes—and subsidies should provide incentives to decarbonize the transport sector and incentivize electric mobility. Tax incentives promoting: (i) energy efficiency of buildings; (ii) production of energy from renewable sources in residential and services sectors are foreseen in the 2022 State Budget; and (iii) low-carbon products and services are expected to be introduced by 2025.

12. A well-designed carbon pricing reform would help accelerate transition towards carbon neutrality. To reach carbon neutrality by 2050, Portugal GHG emission should reach between 47mts and 39mts in 2030. Applying the IMF/World Bank's Carbon Price Assessment Tool (CPAT), staff simulates the impact of existing, planned, and potential measures to reform carbon pricing on GHG emissions, the economy and income distribution (Table 5).[22, 23] Main conclusions:[24]

- *Preserving current status quo (baseline), e.g., keeping the current carbon price at US$28/tCO2 as well as the coverage of the carbon tax and the existing level of energy subsidies would not prevent GHG emissions from growing over time.* Under the baseline, specifically assuming that all else remaining the same, staff assesses GHG emissions to increase from an estimated 55 million tons (mts) in 2022 to 58 mts (+4.7 percent) in 2030.

- *A higher carbon price would reduce emissions but still fall short of putting Portugal on a trajectory towards carbon neutrality in 2050 under current policies.* Assuming linearly increasing carbon price from the baseline level of US$28/tCO2 to US$75 (100) /tCO2 in 2030, GHG emissions are projected to drop by 1.3 (5.3) percent compared to the 2022 estimated level, reaching 55 and 53 mts by 2030.[25] This is partly because the tax would apply to a relatively narrow tax base (see next scenario).

[21] Energy subsidies are projected to decline from 1.2 percent of GDP in 2019 to 0.67 percent in 2025 (IMF Climate Change Indicators Dashboard.

[22] The Carbon Pricing Assessment Tool (CPAT) was developed by IMF Fiscal Affairs department and the World Bank. The tool allows for simulation of the impact of carbon taxation as well as other complementary measures. For more details see Parry et al. (2014).

[23] Adão et al. (2022) estimate that, under current policies, carbon neutrality will be achieved by 2120. Assuming optimal policies in the renewable and fossil fuel sectors are adopted, they estimate it would be achieved by 2070.

[24] The results are surrounded by large uncertainty, for example, as the CPAT is not a general equilibrium model, it does not fully reflect behavioral responses of households and economic sectors and their interactions in response to higher carbon prices.

[25] The assumption of US$75/tCO2 and US$100/tCO2 is based on Stiglitz, Stern et al. (2017), who suggest that the explicit carbon-price level consistent with achieving the Paris temperature target is at least US$40–80/tCO2 by 2020 and US$50–100/tCO2 by 2030.

- *Increasing only the coverage of the carbon tax and removing fuel subsidies and exemptions would increase the effective tax rate which would stabilize GHG emissions at the 2022 level, even if the carbon price remains unchanged at the baseline level.* In a scenario where all the sectors not participating in the ETS would be covered by the carbon tax and all the fuel subsidies and exemptions would be removed, GHG emissions are projected to reach 56 mts in 2030 (0.9 percent higher than the 2022 estimate).

- *To approach its intermediary objective to reach carbon neutrality by 2050, Portugal will need to implement a gradual reform combining a higher carbon price with a higher carbon tax coverage and elimination of fuel subsidies.* Combining a gradual elimination of fossil fuel subsidies and carbon tax exemptions with linearly increasing carbon price to US$ 100/tCO2 would significantly increase the effective price of carbon and thus eliminate incentives to pollute environment. In such a scenario, GHG emissions are projected to drop to 48 mts by 2030, close to the Portugal's intermediary objective of reaching carbon neutrality by 2050.[26]

Table 5. Portugal: Assumptions and GHG Change Under Baseline and Alternative Scenarios

		Assumptions			
		Carbon Price	Fuel Subsidies and Exemptions	Coverage of Carbon tax	GHG change compared to 2022
Scenarios					
a.	Baseline	Unchanged over the projection horizon at US$28/tCO2e.	Unchanged at current level.	Unchanged at current level.	4.7%
b.	$75USD	Linearly increases to US$75/tCO2e by 2030.	Unchanged at current level.	Unchanged at current level.	-1.3%
b.	$100USD	Linearly increases to US$100/tCO2e by 2030.	Unchanged at current level.	Unchanged at current level.	-5.3%
c.	Higher coverage	Unchanged over the projection horizon at US$28/tCO2e.	Gradually reduced to reach zero by 2025.	Carbon tax complementary to ETS coverage	0.9%
d.	$100USD & high coverage	Linearly increases to US$100/tCO2e by 2030.	Gradually reduced to reach zero by 2025.	Carbon tax complementary to ETS coverage	-13.5%

13. A gradual carbon price reform—as described under scenario "d"[27]—seems the most effective in achieving carbon neutrality by 2050, although with large distributional consequences for lower income households. Specifically:

- *Higher carbon price and broader carbon tax coverage would bring about significant benefits as well as create efficiency costs.* If monetized, estimated co-benefits of the reform would reach an annual average at 0.2 percent of GDP. About 81 percent of the benefits would be due to domestic environmental co-benefits, such as less traffic congestion and lower number of

[26] Note that if prices are raised to US$ 75/tCO2 on the broader tax base, the GHG emissions drop only to 50 mts by 2030.

[27] A gradual reform combining a higher carbon price with elimination of fuel subsidies and higher carbon tax coverage.

accident-related externalities. Remaining 19 percent would come from better air quality and lower number of deaths. The global climate benefit is estimated to bring additional 0.1 percent of GDP, increasing the total welfare benefit to 0.3 percent of GDP.[28] Nonetheless, as the cost of adopting cleaner technology is expensive, a carbon price of about US$100/tCO2 would entail some costs.[29] For example, higher non-road oil and kerosene prices would impact the shipping transportation and aviation, possibly hurting competitiveness of Portugal's tourism sector.

- *Higher carbon price would have a large impact on energy prices and weight on most vulnerable households, which would need to be addressed with offsetting measures.* Energy prices would respond sharply in scenario "d". Specifically, gas prices are projected to increase by more than 40 percent, diesel by more than 30 percent, gasoline by about 25 percent and electricity by 10 percent. As the share of energy in households' consumption remains high, e.g., direct energy consumption represents almost 20 percent of total consumption of lower income groups, the projected price increase would heavily impact on most vulnerable households.

- *The overall economic impact critically depends on how the newly generated revenue from the carbon tax is distributed back to the economy.* A gradual increase of both the coverage and the carbon price could raise public revenues by about 2½ percent of GDP (USD$7.4 billion) by the end of the projection horizon in 2030 (Figure 4). Newly generated revenue from carbon taxation could be used to: (i) address critical public investment gaps; (ii) offset the regressive effect of the carbon tax on the most vulnerable households; and (iii) reduce labor and/or corporate tax to avoid economic inefficiencies linked to double taxation.

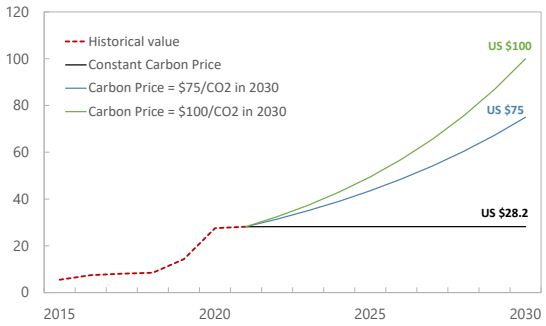
[28] Climate benefits include global climate benefits—common to all countries—and benefit to future generation.

[29] These costs correspond to the value of foregone consumption to fossil fuel consumers, less savings in supply costs. Effectively, efficiency costs reflect the annualized costs of adopting cleaner, but more expensive, technologies, net of any savings in lifetime energy costs. In scenario "d", the efficiency cost is estimated to reach 0.38 percent of GDP in 2030.

Figure 4. Impact of Carbon Pricing Reform

Even a significantly higher price of carbon…

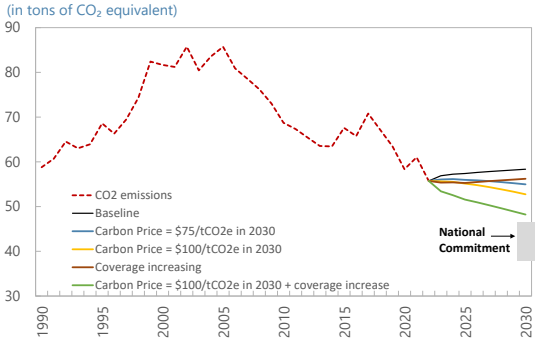
Carbon Price Trajectory, 2015-2030
(US$ per tCO2e)



Source: World Bank Carbon Dashboard and IMF staff calculations.

… would not lead to required GHG emissions reduction if not combined with further measures.

Portugal: GHG Emissions Over Time, 1990-2030
(in tons of CO_2 equivalent)



Source: UNFCCC GHG Data Interface and IMF staff calculations.

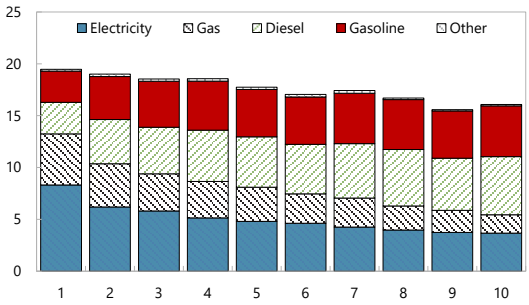
Higher carbon prices, not supported by other measures, …

Energy Price Changes with Reform in 2030

Fuel	Unit	Baseline	Carbon tax $100 + increase coverage	% change
Electricity	US$ per kwh	0.18	0.19	10.1%
LPG	US$ per liter	0.76	1.12	48.2%
Natural gas	US$ per gigajoule (GJ)	14.03	19.92	42.0%
Diesel	US$ per liter	1.56	2.08	33.3%
Gasoline	US$ per liter	1.80	2.27	26.4%
Non-road oil	US$ per barrel	68.32	165.70	142.5%
Kerosene	US$ per liter	1.20	1.73	43.6%

… would weigh mainly on low-income households…

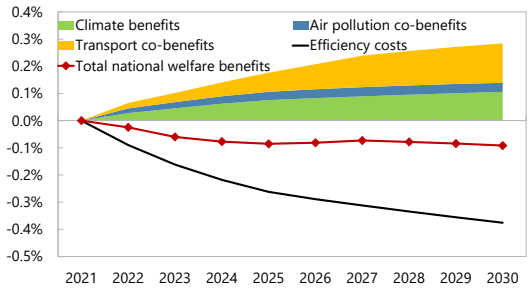
Household Direct Energy Consumption by Decile
(mean; in percent of household consumption)



Sources: Eurostat microdata, and IMF staff calculations.
Note: Gas covers natural gas and LPG.

…and results in significant efficiency cost.

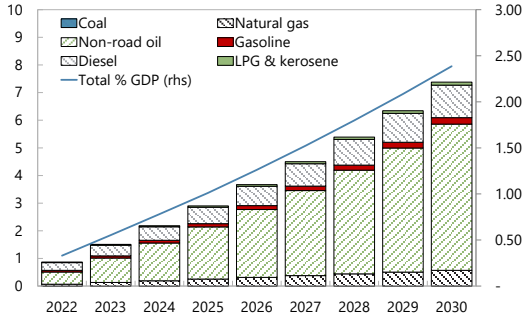
Portugal: Domestic Cost and Benefit of Carbon Price Reform
(Monetized Impact in Percent of GDP)



Notes: Note: Shows monetized net welfare benefits. Economic costs are deadweight losses from the tax before revenue recycling.
Sources: IMF CPAT tool.

However, it would generate public revenue that could be used to address private and public market failures.

Additional Fiscal Revenues with Carbon Price Reform
(lhs: real 2021 US$bn; rhs: % of GDP)



Sources: IMF CPAT tool.

E. Policy Conclusions

14. Portugal was among the first countries in the EU to set ambitious objectives and targets, develop plans, and introduce measures to address increasing climate-related challenges. Portugal's energy-intensive sectors participate in the EU-ETS. Portugal met its 2020 targets on non-ETS emissions, with the share of renewables in heating and cooling reaching 41 percent, and the share of renewable energy in overall energy consumption increasing by 11 percentage points between 2005 and 2019, reaching about 30 percent of gross final energy demand in 2019. The government aims to further increase the share of renewables to 47 percent by 2030—among the highest in the EU—and to improve its energy efficiency.[30] Sector-specific emission and energy efficiency measures outlined in the NECP, such as for transport, industry, and electricity, will contribute to lower GHG emission. Policies increasing production of green hydrogen and other renewable gases (biomethane) and electricity generation from solar and offshore wind platforms combined with renovation of buildings—one of authorities' priorities—will help reduce energy consumption and attain energy efficiency targets. Since 2015, a carbon tax has been charged on most energy products, generating additional revenue, which together with the EU-ETS allowances contribute to Portugal's environmental Fund.

15. Portugal's economic recovery plan places a strong emphasis on accelerating energy transition. The measures and funding (almost 40 percent of Portugal's allocation) as set out in Portugal's RRP— supporting sustainable mobility, energy efficiency, higher share of renewables, decarbonization and the bio-economy—are expected to support the decarbonization and objectives set out in the NECP and RNC. The plan sees green transition as an opportunity to leverage the Portuguese economy towards sustainability by promoting technological advancement, job creation and preservation of natural resources.

16. Nonetheless, to achieve carbon neutrality in 2050, more effort would be required. The economy remains heavily reliant on imported fossil fuels, which accounted for 74 percent of primary energy supply in 2019 (44 percent oil, 25 percent natural gas and 6 percent coal). Additional policies and measures will be required in order to increase the share of renewables to 47 percent. Similarly, the targets aiming at reducing energy import dependency below 65 (19) percent by 2030 (2050) as set by NECP (RNC) seem ambitious and achieving these goals will require strong and sustained measures to reduce fossil fuel demand across sectors. Special focus will be required to reduce oil demand in the transport sector as 94 percent of transport energy demand was covered by oil, and transport GHG emissions increased by 10 percent from 2014 to 2019. Faster reduction of carbon tax exemptions would increase the effective price of carbon, contributing to elimination of fossil fuels subsidies—estimated at 0.6 percent of GDP in 2021— and contributing to decarbonization of the economy. With a large share (two thirds) of buildings not meeting energy performance requirements, the renovation of both public and private buildings would also need to be advanced.

[30] The final assessment of the Portugal NECP by the EC (EC (2020)) assumes the energy efficiency targets to be achieved through measures under Article 7 of the EU Energy Efficiency Directive.

17. Increasing price of carbon could help achieve carbon neutrality if combined with other reforms, including on energy subsidy and larger coverage of the carbon tax. Under current policies, staff estimates that increasing carbon price from current US$28 t/CO2e to US$75(100) t/CO2e would reduce GHG emissions by 11(15) percent and thus not put the country on the path of carbon neutrality by 2050. The limited impact of higher carbon price would be a results of existing tax exemptions and reduced rates. Combining higher carbon price with energy subsidy reform and larger coverage of the carbon tax, would reduce GHG emissions to 48 t/CO2e by 2030 and place Portugal on a trajectory towards carbon neutrality, justifying a need to minimize the existing tax exemptions and reduced tax rates. Increasing the price of pollution would generate additional public resources, that can finance reduction of other (more distortionary) taxes, transfers to vulnerable households, investment in infrastructure, clean technologies, and innovations.

18. Measures to support carbon pricing reform are also critically important. Measures outlined in NECP and RNC, such as: (i) investment in public transportation infrastructure and urban planning; (ii) renewable-based power generation; (iii) introducing or raising efficiency standards, (iv) water, land and forest management; and (v) investment in R&D initiatives will also help accelerate transition towards carbon neutrality.

19. To avoid further impact from climate change, additional specific policies and measures will be required. As floods, coastal erosion, droughts, heat waves and rural fires are expected to become more frequent and extreme in Portugal, investments in risk prevention and preparedness, and climate change adaptation, including improvement in water management, rural fire prevention, circular economy, and waste management, may also be needed. Additional considerations include exploring offshore wind and ocean energy and increasing solar energy generation. Improving energy efficiency of buildings through well-designed building renovation programs remains a long-standing priority as well as addressing high energy intensity in the transport sector.

20. The authorities are developing plans to shield the most vulnerable from the side effects of the green transition. To address energy poverty, the authorities are developing a National Long-Term Strategy analyzing causes of energy poverty, setting out objectives for reducing energy poverty, and proposing specific measures to achieve the objectives. Special attention is paid to measures contributing to: (i) improving energy efficiency of homes, (ii) better access to energy services, (iii) improving energy literacy, and (iv) reducing the burden of energy consumption. Furthermore, the NECP and RRP foresee additional measures to combat energy poverty and further develop instruments to protect the most vulnerable.

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