EXECUTIVE BOARD MEETING

SM/22/135
Correction 1

June 23, 2022

To: Members of the Executive Board

From: The Secretary

Subject: **Portugal—Selected Issues**

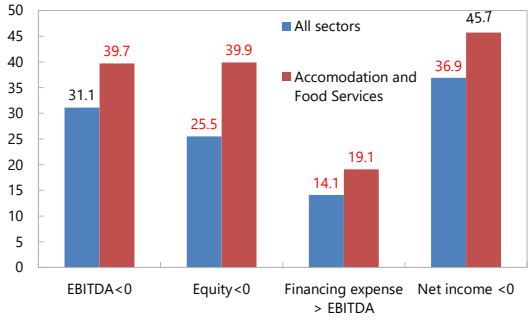
Board Action:	The attached corrections to SM/22/135 (6/8/22) have been provided by the staff:
Evident Ambiguity	**Page 37**
Factual Errors Not Affecting the Presentation of Staff's Analysis or Views	**Pages 3, 4, 11, 20, 22, 26**
Typographical Errors	**Pages 5, 6, 12, 30, 43**
Questions:	Ms. Duttagupta, EUR (ext. 38583) Mr. Dybczak, EUR (ext. 35645) Mr. Tulin, EUR (ext. 34938)

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

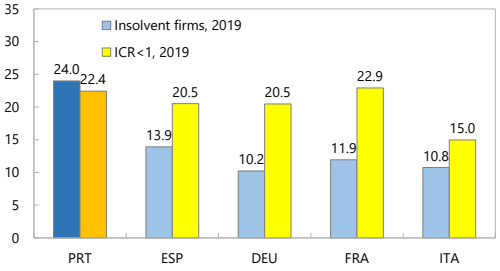
1. Prior to the Covid-19 pandemic crisis, a large share of Portuguese firms already exhibited elevated financial risks. Portuguese corporates were on a deleveraging trend after the European sovereign debt crisis in 2012–13 until the 2020 pandemic. On a consolidated basis, NFC sector's aggregate equity 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)



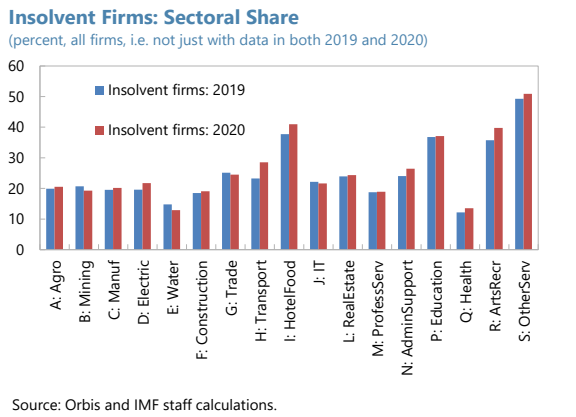
Source: Orbis and IMF staff calculations.
Note: sample limited to firm with data in both 2019 and 2020.

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 26.46 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

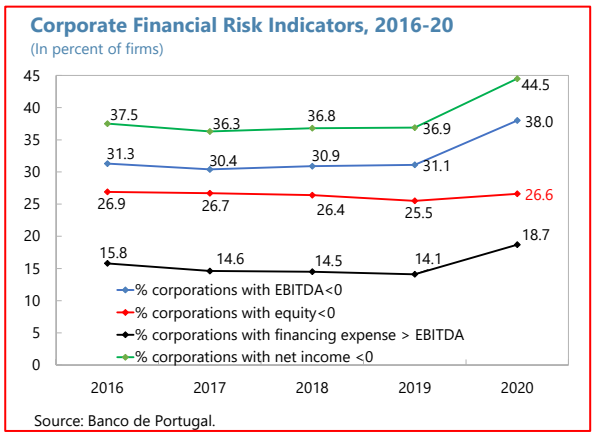
[1] Prepared by Lakshita Jain (University of North Caroline at Chapel Hill) and Volodymyr Tulin (EUR).

[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.

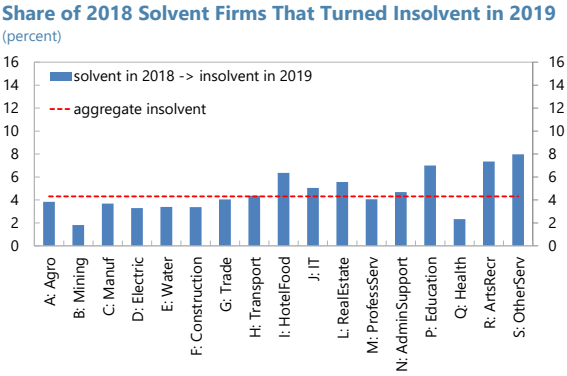
in 2019 became insolvent in 2020.[3] This transition into insolvency in the three most affected NACE1 sectors rose to about 14 percent from about 6–8 percent in the previous year. Also, the exit rate rose disproportionately more among the previously solvent firms—the share of insolvent firms that exited 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.



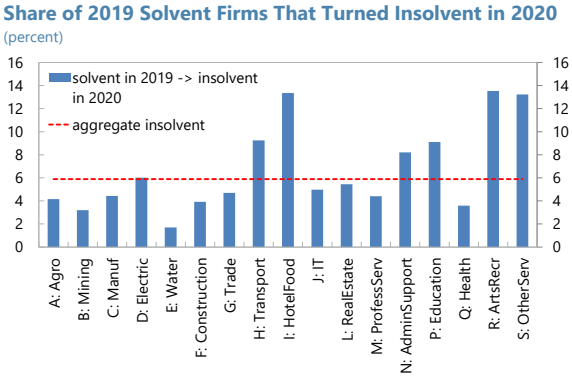
Source: Orbis and IMF staff calculations.



Source: Banco de Portugal.



Source: Source: Orbis and IMF staff calculations.



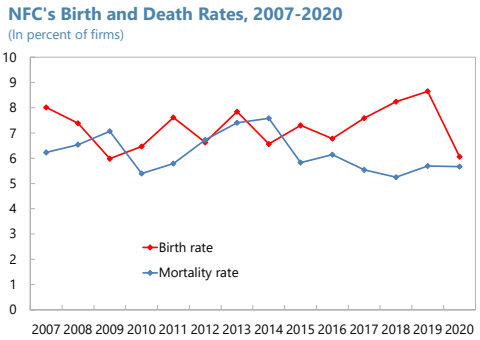
Source: Orbis and IMF staff calculations.

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

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

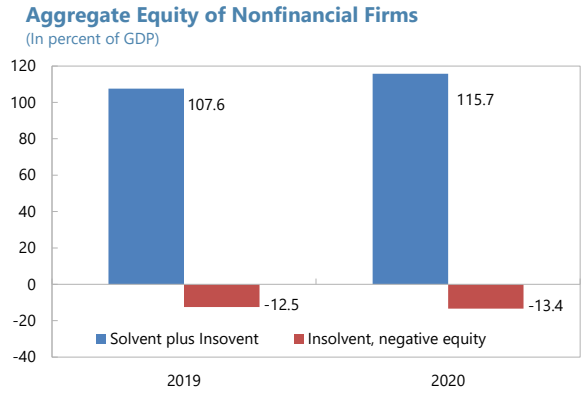
[4] Although lack of 2020 Orbis data reporting does not strictly indicate an exit, aggregate share of firms without 2020 data at 5.9 percent matches well firm closure rates of 5.7 percent in the BdP's Central Balance Sheet Database.

the lowest level since 2009.[5] For the affected sectors, while exit rates did not move much, the birth rate fell even more sharply.

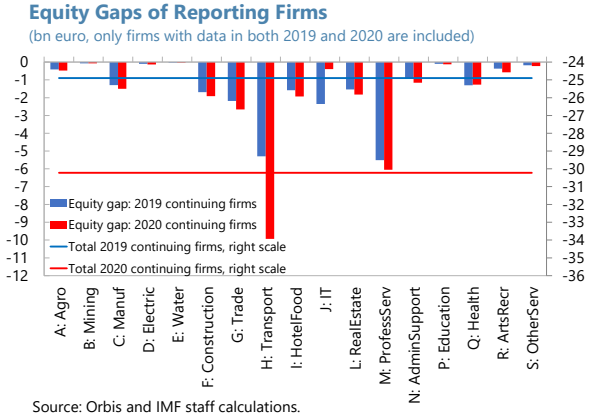


Source: Banco de Portugal.

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.

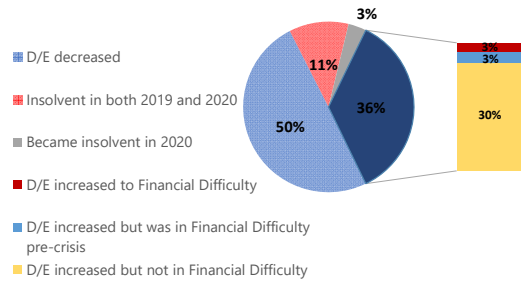
5. A large share of Portuguese firms experienced an increase in leverage and the share of leveraged and insolvent firms increased more than in the EA overall. Portugal was relatively harder hit by the pandemic reflecting its reliance on tourism (GDP fall of 8.4 percent in 2020 vs. 6.5 percent in the EA). In turn, Portuguese NFCs were relatively more affected. The leverage ratio

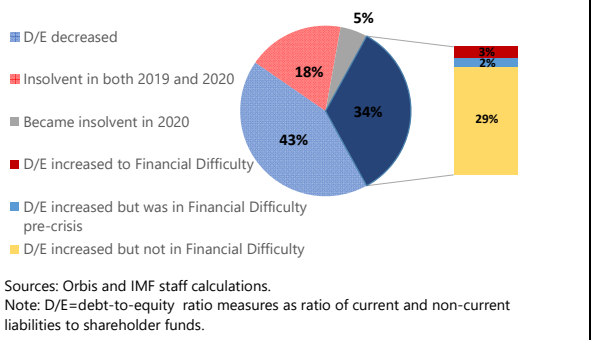
[5] Eurostat data for 2020 indicates a comparable large drop of 24 percent in new business registration and a small increase of about 3 percent in bankruptcy filings compared to 2019. Moreover, bankruptcy filings have been on a downward trend since the 2020:Q1, dropping about 1/4th as of 2022:Q1 relative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

[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.

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 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.

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.

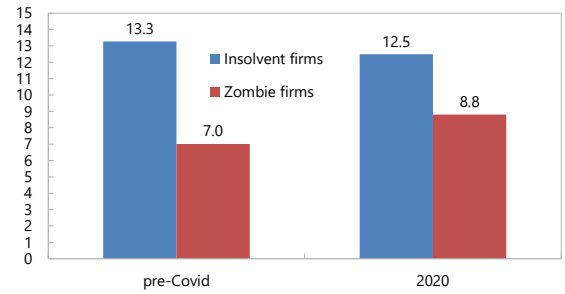
[8] As reported in the December 2021 Financial Stability Report (Banco de Portugal, 2021a), the financial vulnerability indicator using the proportion of operating income allocated to interest payments in each firm, debt of vulnerable firms in the most affected sectors doubled between 2019 and 2020,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

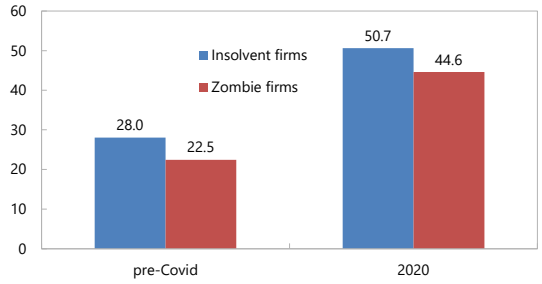
increased reliance on short-term debt,[2] and the share of stage 2 loans that benefitted from the moratoria rose from 15~~7~~ percent in mid-2020 to 30~~2~~ percent in December 2021, implying risks of higher eventual insolvencies and NPLs. On a positive note, if the recent lower flow of new loans to such zombie firms is sustained, financial stability risks would remain contained.[3]

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

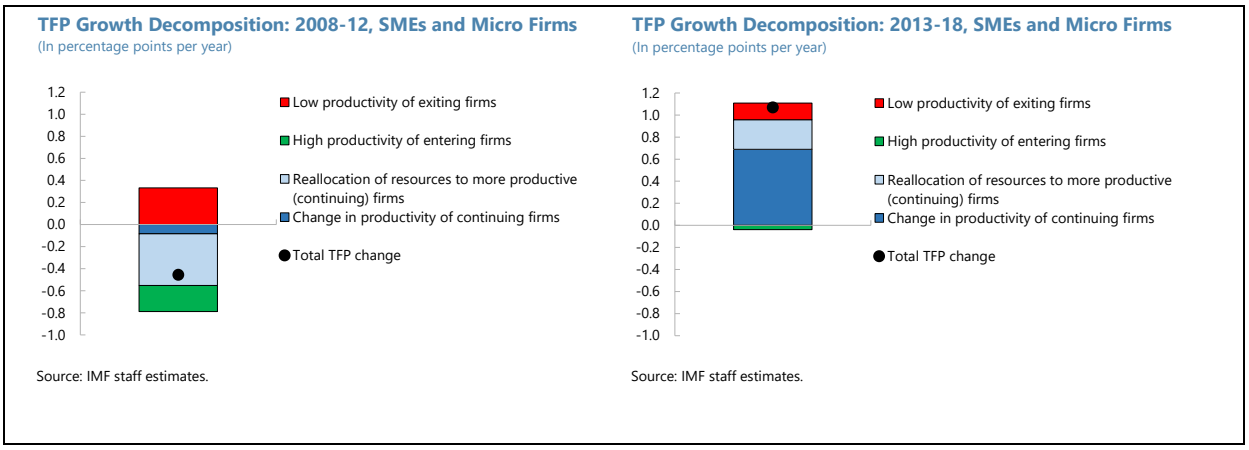
[2] The two groups overlap. Specifically, about half of zombie firms are also insolvent, but only a small fraction of insolvent firms (4 percent in 2019 and 6 percent in 2020) are classified as zombies.

[3] 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.

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~~s~~ 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 (0.10percentage points per year) offset by allocative losses (0.13percentage points per year). In turn, during 2013–17, TFP of large firms grew by almost 3percentage 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, Kozeniausk~~u~~as 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,[4] by allowing across-sector and multi-factor reallocation dynamics.

[4] 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.

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 ~~a quarter~~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).

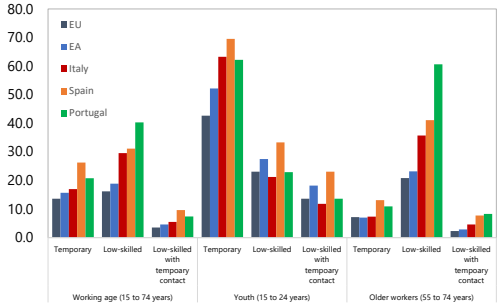
[5] UNWTO Barometer, July 2021.

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

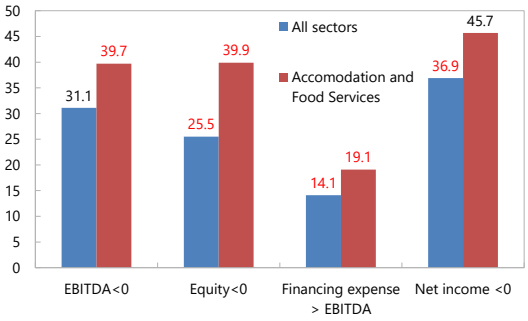
[7] The non-resident component determines two-thirds of the GVA of tourism and is expected to continue to be the main tourism determinant (Banco de Portugal, October 2020).

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]

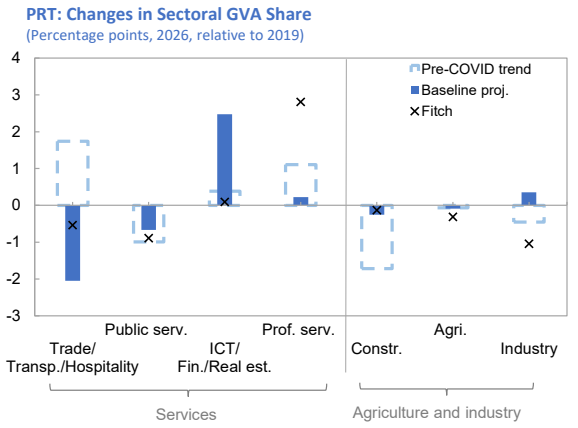
[8] The analysis in this Selected Issues Paper pre-dates Russia's invasion of Ukraine and does not include additional considerations of potentially negative spillovers from the war in Ukraine on tourism prospects.

[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.

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 2020~~1~~1 bulletin).



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

D. Policy Conclusions

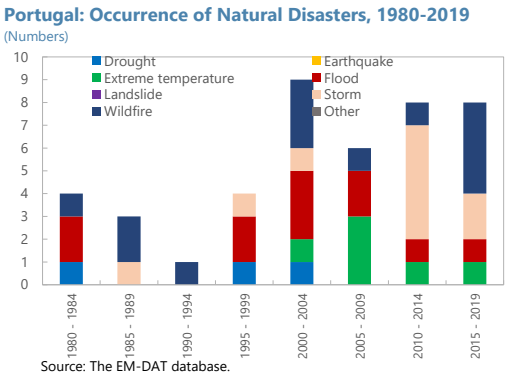
12. Given the economic importance of tourism in Portugal, targeted and time-bound support can play a role in shaping the future of the tourism sector. For viable small and micro firms, liquidity-type support, such as guaranteed loans or lending rate subsidies, etc. could mitigate long-term scarring (see 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.

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]

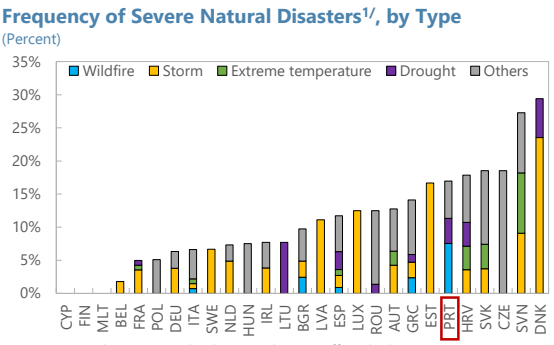
Figure 1. Impact of Climate Change on Portugal

Portugal has been increasingly vulnerable to natural disasters…



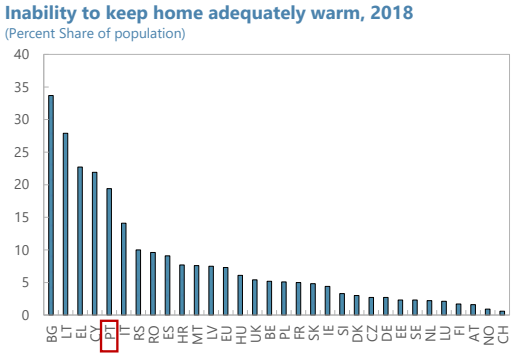
Source: The EM-DAT database.

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



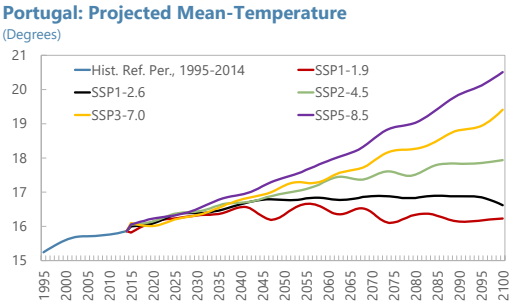
Source: The EM-DAT database, and IMF Staff's calculation.
1/ Severe Disasters are defined by their impact on GDP (larger than the 90th percentile of all the natural disasters in EU27).

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

[7] Adão et al. (2022) ~~quantifies~~ 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.

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 ~~assume~~ 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.

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