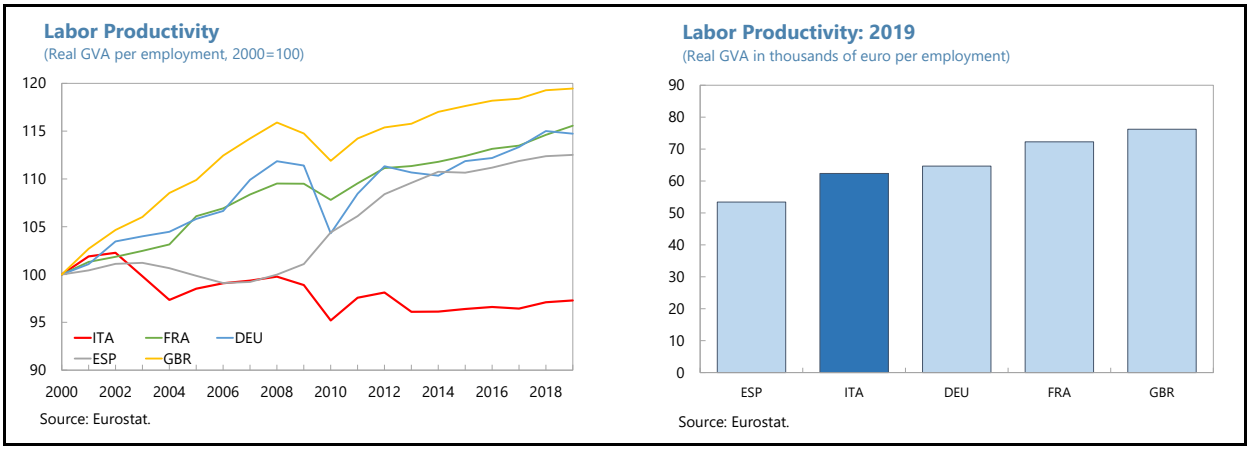
PRODUCTIVITY IN ITALY: SCOPE FOR IMPROVEMENT[1]

This paper investigates the role of structural characteristics on Italy's labor productivity at the regional and sectoral levels. Productivity-enhancing structural factors are found be highly correlated, indicating that reforms are complementary and reinforcing. As a result, a concerted, multi-faceted reform program, as envisaged in the National Recovery and Resilience Plan, would likely be most effective at raising productivity. Improving structural characteristics beyond Italy's national frontier will be crucial to lift productivity towards the level of peer EU countries.

Two Decades of Weak Productivity: Regional and Sectoral Dimensions

1. Italy's productivity has been stagnant in recent decades. Real value added per worker declined by nearly 5 percent, while total factor productivity fell by 13½ percent during 2000–19. Together with the shrinking working-age population, potential growth has been low, and the economy has slowed markedly. Real per capita income in 2019 was about 6 percent below the pre-Global Financial Crisis level. Italy's productivity has also diverged from that of other large European economies.



2. While the absence productivity growth is a common feature across Italy's regions and economic activities, internal productivity gaps have widened over time.

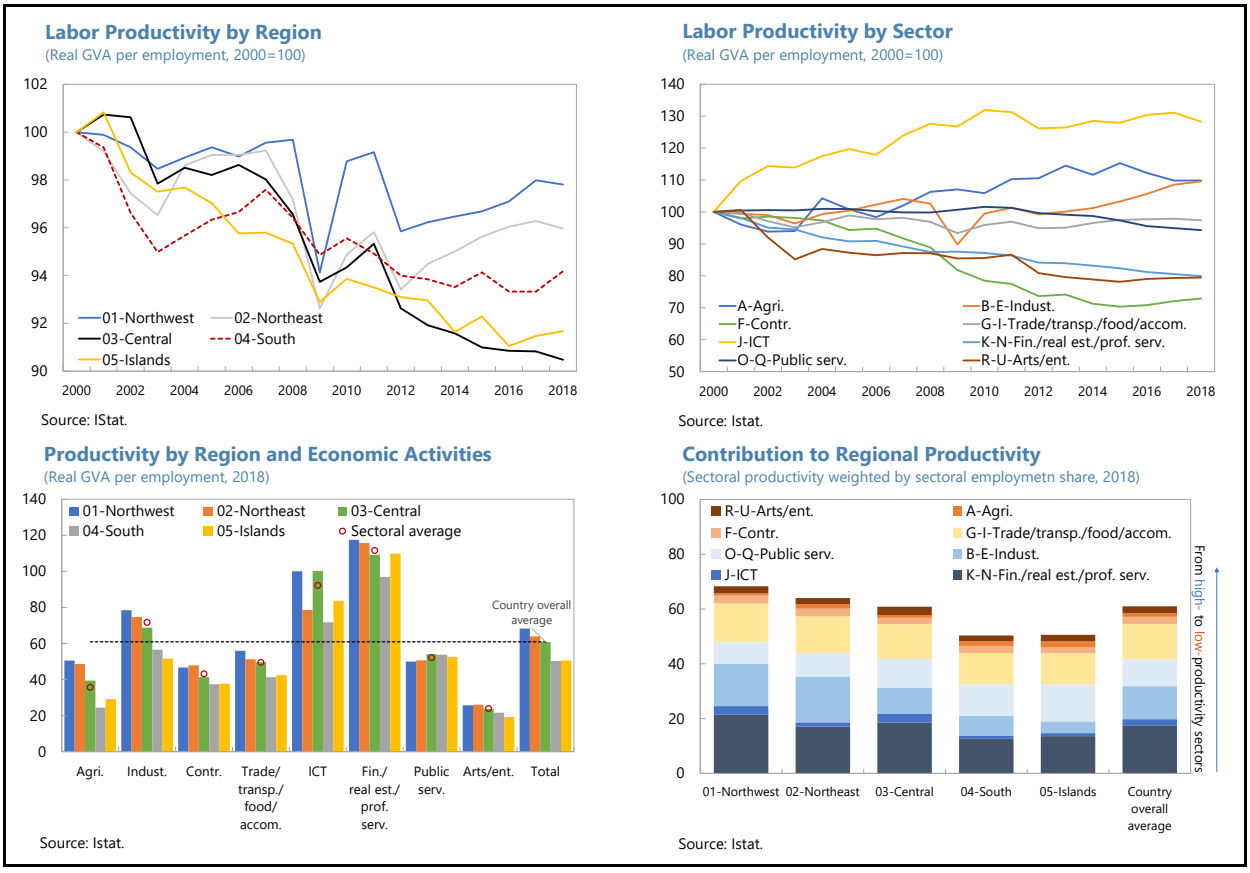
- *Regional productivity* is uneven, with Northern regions being more productive than the rest of Italy. Nonetheless, the declining productivity trend is broad based, with Central, Southern and Island regions experiencing the largest productivity declines of 6 and 10 percent, respectively, over the past two decades. Despite being relatively more productive, Northern regions have also seen some weakening in productivity, although with gradual improvements in recent years.

- *Sectoral productivity* differentials are also significant, with several activities displaying declining productivity. In particular, relatively labor intensive and low-skilled construction and arts-and-entertainment have suffered productivity declines of more than 20 percent during 2000–19. Most other sectors have not experienced any significant productivity growth, with the notable exceptions of information and communication technology (ICT), agriculture and, more recently,

[1] Prepared by La-Bhus Fah Jirasavetakul and Zhongxia (Sam) Zhang (both EUR).

industry. However, outperforming sectors of ICT and industry account only for about one-fifth of total value added and employment.

3. The poor productivity of lagging regions reflects both their weaker productivity across most activities and their greater concentration in less-productive activities. Southern and Island regions have aggregate productivity well below the national average, reflecting a faster decline than in other regions. This reflects that these regions: (i) are less productive than others across nearly all activities; and (ii) have a higher concentration in low-productivity activities (such as trade and hospitality, construction, and agriculture), which constitute their main sources of activity and employment. In addition to sectoral specialization, regions also differ greatly by firm size, which can affect their productivity.



Productivity Determinants and their Complementarity

4. The determinants of Italy's low productivity have been well researched in the literature, with individual studies tending to focus only on one or a few causal factors. Using a cross-country or Italy-specific perspective, previous literature has identified numerous structural variables as important contributory factors to productivity[2]—including public sector efficiency,[3]

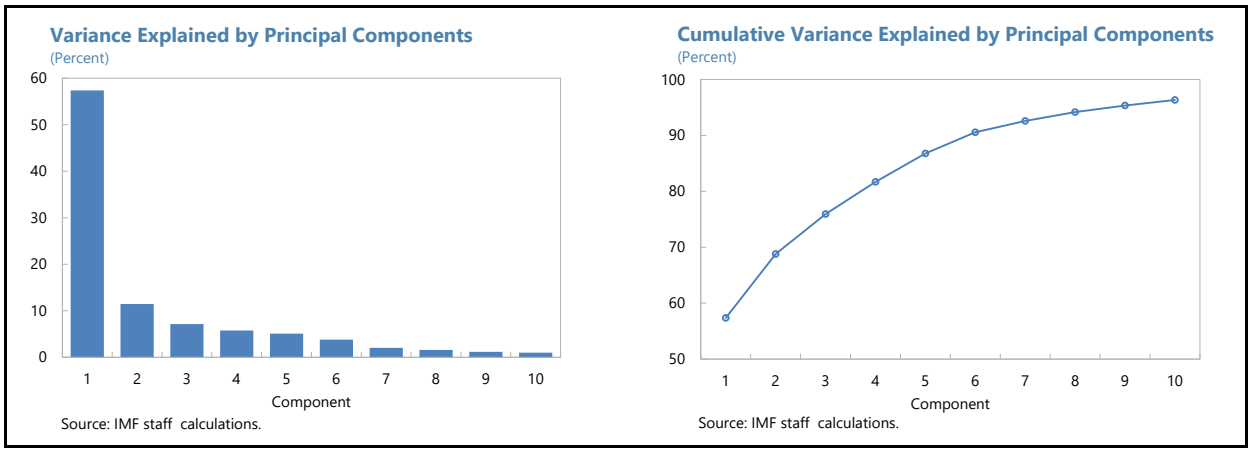
[2] See Bugamelli and others (2018) for a comprehensive review of the literature on the determinants of Italy's productivity growth.

[3] Andrle and others (2018); Albanese and others (2015); Giordano and others (2020); OECD (2021).

quality of the judicial system,[4] regulatory complexity,[5] public capital stock,[6] incentives for innovation and digitization,[7] and labor market and product market regulation.[8] Undertaking reforms to improve these structural characteristics is found to raise productivity. However, each of these factors is assumed to contribute to productivity separately from the others, and even when more than one factor is considered, the possibility that effects could be complementary is overlooked.[9, 10]

5. However, productivity-enhancing structural characteristics are found to be highly correlated, suggesting that reforms are complementary and reinforcing. Coe and Snower (1997) recognize the potential reinforcing effects of reforms in the context of labor market policies, which are found to be more effective when coupled with reforms to improve institutional quality. In addition, Blanchard and Giavazzi (2003) find that reforms to enhance product market competition help to facilitate reforms to deregulate the labor market.

6. For Italy, over half the informational content from a large set of structural indicators can be described by a single common factor, consistent with high complementarity. Considering 56 structural indicators across some 21 Italian regions (Table 1) during the years 2015–19[11], and using principal component analysis (PCA, see Box 1), reveals that nearly 60 percent of the total variance in the original 56 series is accounted for by the first principal component (PC1). The vast majority of the corresponding PCA loadings conform with economic intuition (Table 2).



[4] Esposito and others (2014); Guiso and others (2015); Giacomelli and Menon (2017); Bank of Italy (2020).

[5] Di Vita (2018).

[6] Marrocu and Paci (2010).

[7] Calligaris and others (2016); Bank of Italy (2020); ECB (2021).

[8] Andrle and others (2018).

[9] For instance, Andrle and others (2018) assume that the productivity gains from individual reforms are additive.

[10] Also, in models where several structural variables are included as explanatory variables, high correlation between structural variables suggests that the individual estimated coefficients will be biased.

[11] While most structural variables are slow moving, average values of structural indicators during 2015–19 are used, to avoid potential variation due to business cycles.

In addition, the explanatory power of the second principal component is considerably lower, indicating that PC1 by itself is a good summary statistic.[12] This in turn, points to the very high correlation among the original 56 structural indicators. PC1 is therefore a good potential candidate for explaining the productivity performance of Italy's regions.

Box 1. Principal Component Analysis of Structural Indicators—Methodology and Data

Principal Component Analysis (PCA) is a statistical method for extracting information from a set of individual, potentially correlated, data. It does so by identifying signals from each of the N original series and transforming them into N new uncorrelated variables ("principal components") that are linear weighted combinations ("loadings") of the original data. Hence, principal components are an ordered sequence of new uncorrelated variables, where the ordering is given by the how much of the variance in the original data is captured by each successive principal component. Hence PCA is a technique for reducing the dimensionality of data while limiting the loss of informational content.

A comprehensive dataset of 56 structural indicators at the regional level was compiled. The set includes both high-level institutional variables (e.g., indicators of the judicial system and government characteristics) in addition outcome variables (e.g., education, health, demographics, R&D, digitization, financial development, banking and corporate sector performance, and social conditions). The dataset encompasses productivity-enhancing indicators considered in the literature, as well as many more. To avoid potential variation due to business cycles (even though structural variables are typically slow moving), average values during 2015–19 are used.

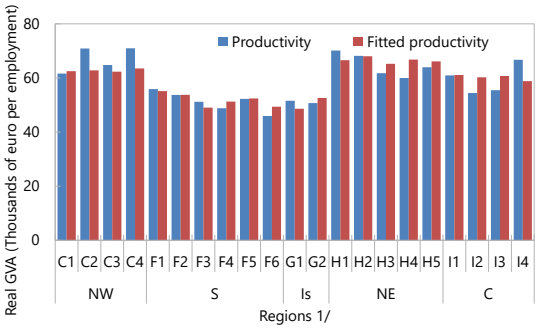
7. Region-specific values of the first principal component of structural characteristics are found to be strongly correlated with differences in regional productivity. Simple OLS regressions show that an improvement in a region's PC1 is associated with regional higher productivity, with a high degree of statistical significance. The model also has reasonable goodness of fit, with a larger R-squared value than found in other studies, pointing to the importance for productivity of simultaneously improving multiple structural characteristics. The productivity impacts of PC1 remains significant when using a difference-in-differences approach to mitigate potential endogeneity and reverse causality issues (Box 2).

Regressing Regional Productivity on Principal Components

Dependent variable: Log of Avg. Regional GVA per Employment, 2015-19			
	(1)	(2)	(3)
Principal component 1	0.0199***	0.0199***	0.0199***
	(0.00280)	(0.00286)	(0.00288)
Principal component 2		0.00271	0.00271
		(0.00641)	(0.00645)
Principal component 3			0.00734
			(0.00816)
Constant	4.070***	4.070***	4.070***
	(0.0155)	(0.0158)	(0.0159)
# of observations	21	21	21
R-squared	0.726	0.729	0.741

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Predictive Power



Source: IMF staff calculations.
1/ See Appendeix Table A.1 for region codes.

[12] The first and second components explain about 57 and 11 percent of the variance in the structural indicators, respectively.

Box 2. Impacts of Structural Factors on Productivity at the Regional and Sectoral Levels

The large variation in structural characteristics (measured by PC1) across Italian *regions* and different exposures to the public sector across *economic activities* can be used to assess the causal relationship between PC1 and productivity under a difference-in-differences (DID) framework. In a similar vein to Giordano and others (2020), the identifying assumption is that productivity of sectors that are more dependent on the public sector (for example, due to licensing and permits issued by public administration) would be more affected by PC1 (especially for structural factors that are related to institutional quality). The causal effects of PC1 can then be captured by the cross-region difference in productivity gaps between sectors with high and low exposure to the public sector. In this context, the degree of exposure to the public sector can be regarded as "treatment intensity" and PC1 as the "treatment" variable. The reduced-form DID regression can be written as:

$$Y_{i,s} = \beta \cdot PC1_i + \alpha \cdot PC1_i \cdot GExp_{(i),s} + \boldsymbol{\theta} \cdot \boldsymbol{X}_{i,s} + \varepsilon_{i,s}$$

where $Y_{i,s}$ is (2015–19 average) productivity (measured by real GVA per employment) in region i and sector s; $PC1_{i,t}$ is the first principal component of the 56 structural indicators (as described and computed in Box 1); $GExp_{(i),s,t}$ is (region- and) sector-specific exposure to the public sector; and $\boldsymbol{X}_{i,s,t}$ is a vector of sector- and region-specific control variables. Several variables are used to measured regional and sectoral exposure to the public sector, including the contribution of public services in each of the sectoral productions from the input-output table (OECD. 2021) and the share of public employment in a region (Eurostat, 2020).

Empirical results highlight the positive relationship between the first component of structural indicators and labor productivity. A unit improved in the first principal component of structural indicators is associated with nearly two percent increase in the regional productivity for a specific sector. Having higher exposure to the public sector could boost the impacts of better structural indicators on productivity by another 0.1–0.3 percent. The results are robust to various definitions of exposure to the public sector, and inclusions of control variables and regional and sectoral fixed effects.

Italy: Difference-in-differences Regression of Sectoral and Regional Productivity

Dependent variable: Log of (5Y avg. of) sector- and region-specific GVA per						
	(1)	(2)	(3)	(4)	(5)	(6)
PC1	0.019***	0.014*	0.024***	0.019**	0.019**	0.019**
	(0.002)	(0.008)	(0.003)	(0.009)	(0.009)	(0.009)
PC1 # GExp1			0.001***	0.001***		
			(0.000)	(0.000)		
PC1 # GExp2					0.003***	
					(0.001)	
PC1 # GExp3						0.003***
						(0.001)
Agg. region fixed effects	No	Yes	No	Yes	Yes	Yes
Sector fixed effects	No	Yes	No	Yes	Yes	Yes
# observation	168	168	168	168	168	168
R2	0.0488	0.911	0.0565	0.918	0.917	0.917

Note: 1/ * p<0.1; ** p<0.05; and *** p<0.01.

Simulating Effects of Structural Improvements

8. The estimated empirical model can be used to simulate the effect of improvements in structural characteristics on productivity. Holding the regional economic structure fixed and using the estimated productivity impacts of structural characteristics from the DID model, two scenarios are considered:

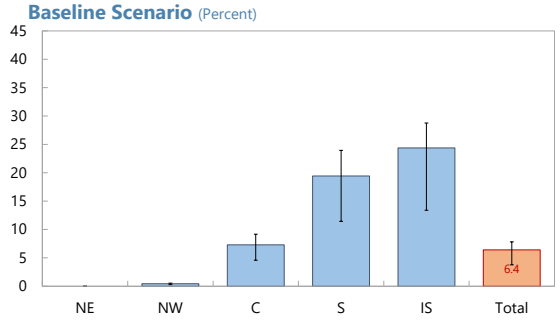
- Each region is assumed to improve its composite indicator of structural characteristics by one quintile. This would raise within-sector productivity by about 20 percent in the South and the Islands and by nearly 10 percent in the Central region, lifting Italy-wide labor productivity by about 6½ percent. This goal is equivalent to assuming that regions improve their structural factors incrementally (i.e., by one quality notch to the next better-performing regional peer) and should be relatively easy to achieve.

- A more challenging target would be for each region to lift its composite indicator of structural characteristics to the 80th percentile of the national frontier. This would raise Italy-wide labor productivity by about 10¾ percent.[13]

9. There is also significant room to expand the national frontier, which would bring larger improvements in productivity. Even in Italian regions with the highest value of the composite structural indicator, structural characteristics (such as quality of government and perception of corruption) still lag well behind other EU peers. Therefore, progressing the national frontier and toward the best performing EU countries could raise productivity by considerably more.

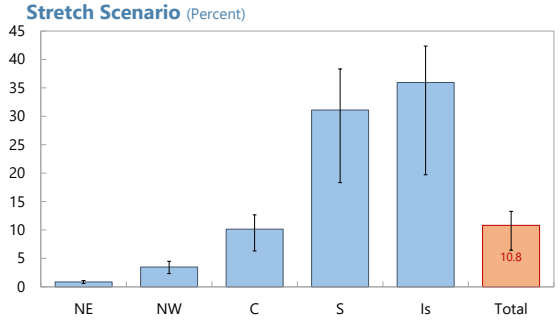
10. Nonetheless, it is important to note that these simulations are based on a reduced-form model and therefore cannot provide information on transmission channels. A "structural" model would be needed to better understand how reforms affect productivity. In this regard, Bugamelli and others (2018) consider how structural determinants affect aggregate productivity by influencing within-firm productivity, reallocation of resources across firms, and the creation and demise of firms.

Productivity Gains from Improving Structural Indicators: Baseline Scenario (Percent)



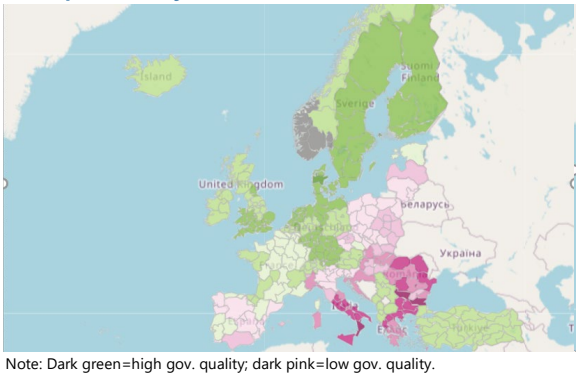
Source: IMF staff calculations.
Note: NUTS2 regions are assumed to improve their PC1 by one quintile.

Productivity Gains from Improving Structural Indicators: Stretch Scenario (Percent)



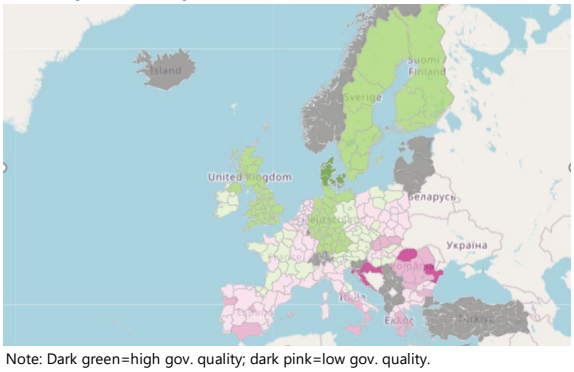
Source: IMF staff calculations.
Note: NUTS2 regions are assumed to improve their PC1 towards 80th percentile.

European Quality of Government Index - 2017



Note: Dark green=high gov. quality; dark pink=low gov. quality.
Source: University of Gothenburg's Quality of Government indicators.

Corruption Perception Index - 2017



Note: Dark green=high gov. quality; dark pink=low gov. quality.
Source: University of Gothenburg's Quality of Government indicators.

[13] Alternatively, one could consider a scenario where productivity in all regions increases to levels in regions with the highest value composite structural indicator (i.e., Emilia-Romagna and Lombardia). This would result in a somewhat larger increase in productivity.

Conclusion and Policy Implications

11. Productivity differences across regions and sectors reflect variation on an array of correlated structural characteristics, suggesting the need for a comprehensive reform push. A wide range of structural characteristics is relevant for labor productivity, and their effects are complementary, rather than additive. This suggests that a concerted, multi-faceted reform program—rather than a series of sequential reforms—would be most effective. Italy's National Recovery and Resilience Plan, which encompasses a comprehensive program of reforms and investment spending, is therefore well designed to raise labor productivity and potential growth. However, while catching up to the national frontier of best practice on structural characteristics is a crucial interim step, pushing out the national frontier is key to lifting productivity to the level of peer EU countries.

Table 1. List of Italian Regions

Code	Area	Region
C1	Northwest	Piemonte
C2	Northwest	Valle d'Aosta
C3	Northwest	Liguria
C4	Northwest	Lombardia
F1	South	Abruzzo
F2	South	Molise
F3	South	Campania
F4	South	Puglia
F5	South	Basilicata
F6	South	Calabria
G1	Islands	Sicilia
G2	Islands	Sardegna
H1	Northeast	Bolzano, Trentino Alto Adige
H2	Northeast	Trento, Trentino Alto Adige
H3	Northeast	Veneto
H4	Northeast	Friuli-Venezia Giulia
H5	Northeast	Emilia-Romagna
I1	Central	Toscana
I2	Central	Umbria
I3	Central	Marche
I4	Central	Lazio

Table 2. Variable Loadings in the First Principal Component

High-level institutional variables	Local government	Staff of local authorities per 100,000 inhabitants	-0.12
		Staff of local authorities age 60+ (percent)	-0.13
		Staff of local authorities with tertiary education	0.04
		Companies owned by local administrations per million inhabitants	0.16
		ROA of active non-financial companies owned by local authorities	0.16
		European Quality of Government index	0.15
		Regional Competitiveness Index	0.16
		European regional Social Progress Index	0.14
	Judiciary system	Duration of civil proceedings SICID	-0.14
Outcome variables	Education	Share of students with adequate Italian	0.17
		Share of students with adequate math	0.16
		Early exit rate from the education system	-0.17
		Population of 25 to 64 years with tertiary education level	0.11
		Share of Labour Force with Tertiary Education	0.04
		Share of Labour Force with Secondary Education	0.13
		Share of Labour Force with Elementary Education	-0.12
		Share of 18-24 year-old not in education, unemployed or inactive	-0.17
	Health	Percentage of obese people	-0.11
		Percentage of smokers	-0.05
		Percentage of people subjects with alcohol consumption risk	0.16
		Rate of at least two chronic conditions	-0.16
		Difficulty in accessing pharmacies	-0.17
		Difficulty accessing the emergency room	-0.16
		Number of community hospitals per 100,000 inhabitants	0.14
	Demographics	Fertility rate	0.09
		Infant mortality rate	-0.09
		Life Expectancy at Birth	0.13
		Share of Elderly Population	0.07
		Dependency Ratio	0.12
	R&D	Patent applications to the EPO	0.14
		R&D personnel (percent of population in the labor force)	0.13
		R&D Total Personnel Rate (in % of total employment)	0.12
	Digitalization	share of customers with home banking agreements	0.07
		share of online transfers	-0.09
		Households with access to the internet at home	0.16
		Households with broadband access	0.15
	Financial development	Bank loans to the private sector (percent of GDP)	0.05
		Bank branches per 100,000 inhabitants	0.16
	Banking and corporate sector	Companies with loans on COVID moratoria or guarantees	-0.16
		share of undercapitalized companies	-0.14
		NPL ratio	-0.13
		Birth rate of enterprises	-0.15
		Death rate of enterprises	-0.15
	Social conditions and crimes	Population at risk of poverty or social exclusion	-0.17
		Population at-risk-of-poverty	-0.17
		Population living in severe material deprivation	-0.15
		Food poverty rate	-0.06
		Number of Robbery Crime per 100,000 inhabitants	-0.07
		Long-term unemployment (percent of labour force)	-0.17
		Social services and benefits of municipalities (percent of GDP)	0.06
		Rate of undeclared work	-0.16
		Gini coefficient after taxes and transfers	-0.12
		Gini coefficient before taxes and transfers	-0.14
		Crude Death Rate (deaths for 1000 population)	0.05
		population)	0.16
		Inter-regional mobility rate (percent, new comers over population)	0.12

Note: mid blue = loading > 0.1 in absolute value and of correct sign; pale blue = loading < 0.1 in absolute value and of correct sign; and white = sign not as expected.

Source: IMF staff calculations.

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