INTERNATIONAL MONETARY FUND

IMF Country Report No. 23/34

SPAIN

SELECTED ISSUES

January 2023

This Selected Issues paper on Spain was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed on December 16, 2022.

Copies of this report are available to the public from

International Monetary Fund • Publication Services
PO Box 92780 • Washington, D.C. 20090
Telephone: (202) 623-7430 • Fax: (202) 623-7201
E-mail: publications@imf.org Web: http://www.imf.org
Price: $18.00 per printed copy

International Monetary Fund
Washington, D.C.

INTERNATIONAL MONETARY FUND

SPAIN

SELECTED ISSUES

December 16, 2022

Approved By
European Department

Prepared By Nicolas Arregui, Ana Lariau, and Yu Shi.

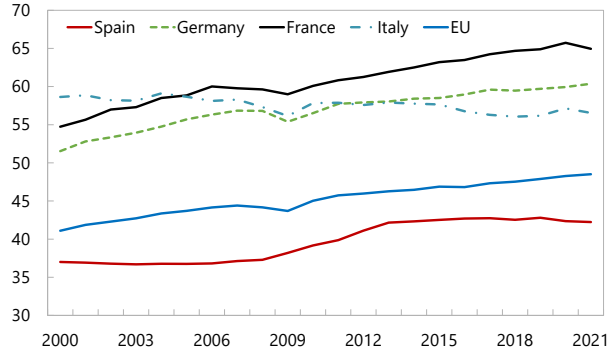
CONTENTS

LABOR PRODUCTIVITY DYNAMICS IN SPAIN: A FIRM-LEVEL PERSPECTIVE[1]

A. Introduction

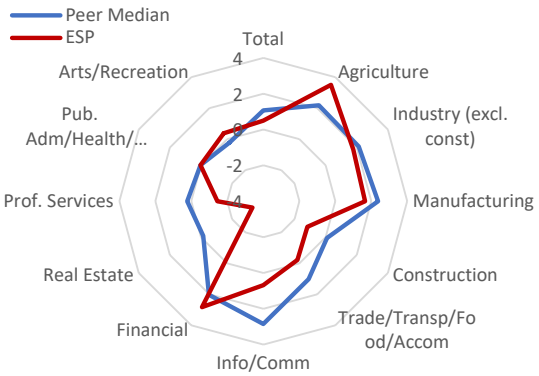
1. Labor productivity has been a long-standing structural challenge in Spain. Productivity performance has been weak across several dimensions: labor productivity levels are significantly lower than in some peer economies, its growth rate has been low and not favored convergence, and differences in output per hour worked across Spanish regions is considerable (IMF, 2018). Moreover, weak labor productivity performance relative to peers holds across sectors, suggesting that cross-cutting drivers are likely to play a more significant role than the productive structure of the economy.

Labor Productivity
(GDP in const. 2015 prices divided by hours worked)



Sources: Eurostat, Haver Analytics, and IMF staff calculations.

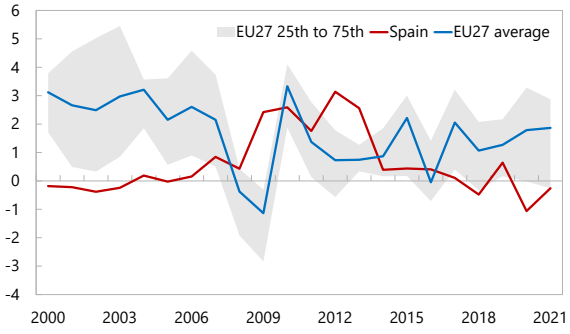
Labor Productivity Growth by Sector 1996-2021
(annual average growth; in percent)



Note: peers include AT, BE, CZ, DE, FR, HR, IT, NL, PT, UK.

2. In the aftermath of the Global Financial Crisis (GFC), labor productivity in Spain exhibited a counter-cyclical pattern driven by the large reduction in employment. The relatively strong productivity growth from 2009 to 2013 was mainly driven by developments in the labor market. The rapid decline in working hours resulted in a faster increase in the capital-labor ratio. Additionally, employment destruction had a bias towards less productive occupation, implying an increase in the average productivity for those who

Labor Productivity Growth
(annual growth rate, in percent)

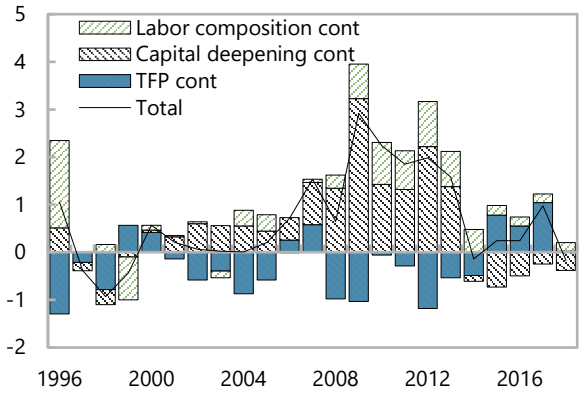


Sources: Eurostat, Haver Analytics and IMF staff calculations.

[1] Prepared by Nicolas Arregui and Yu Shi (both EUR).

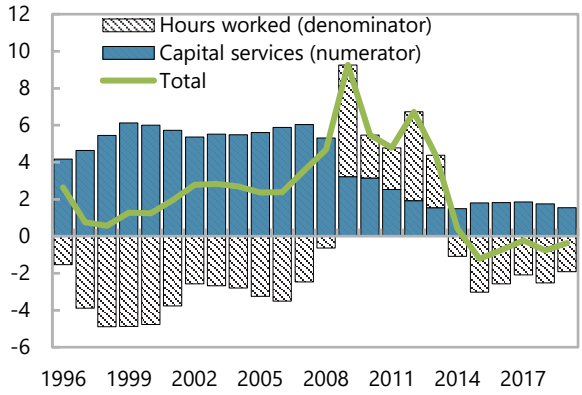
remained occupied. Once labor market conditions normalized, capital deepening[2] settled at a lower contribution level (negative in 2014–19) to labor productivity, reflecting the lower rate of capital accumulation since the GFC. The adoption of measures during the pandemic, particularly with the role played by the strengthened furlough scheme (ERTE), resulted in better labor market dynamics than in past crises. On the flip side, labor productivity performed worse in Spain than in other countries.

Spain Labor Productivity Growth Decomposition
(in percent)



Sources: KLEMs and IMF staff calculations.

Capital Deepening Growth
(in percent)



Sources: OECD, and IMF staff calculations.

3. Total factor productivity (TFP) has been consistently low and lagging peers for decades. A number of factors have been identified as contributing to the sluggish TFP growth in Spain, including the structural weaknesses in the labor market, such as the high share of temporary workers and the wide use of sector-level collective bargaining agreements (Hospido and Moreno-Galbis, 2015), capital misallocation linking to financial frictions from size-dependent borrowing constraints (Gopinath et al. 2017; García-Santana et al. 2020), product market regulation (Andrews and Cingano, 2014; Bank of Spain, 2015), size-related regulations and policies (Almunia and Lopez Rodriguez, 2018; IMF Country Report, 2018), and weak business innovation (OECD, 2021). Spain, nonetheless, has recently put in place reforms that could have a positive impact on TFP. For example, substantial changes in the regulation of temporary contracts were introduced in December 2021 and early results are showing a decline in the share of temporary workers. Reforms also established incentives for the provision of training to workers and revamped the vocational and training system. Furthermore, Spain's Recovery, Transformation and Resilience Plan (RTRP) contemplates improvements to active labor market policies.

4. Sustained policy focus on raising productivity will be important to increase living standards, help rebuild fiscal buffers and make growth more inclusive. A previous study by the IMF (IMF, 2015) discussed the determinants of TFP in the aftermath of the GFC and emphasized the importance of product market regulation as well as the size-related tax incentives. Building on this earlier work, this chapter provides an updated assessment of the drivers of labor productivity in

[2] Defined as the ratio of capital services (i.e. stock adjusted by quality) over total hours worked.

recent years, focusing on both TFP and firm investment. The empirical analysis benefits from the rich information in firm financial statements to provide a deep-dive study on differences across firms based on their size and age. Given that firm-level data is available with a significant lag, the analysis of productivity developments during the pandemic is beyond the scope of this chapter. The chapter also includes a review of Spain's ambitious reform commitments under the recovery plan and concludes with recommendations for further action.

B. Data and Empirical Strategy

Data

5. This chapter uses firm-level data that covers over 1.2 million Spanish firms[3] during the period of 2003–2019. The microdata is from the Orbis Bureau Van Dijk (BvD) database, complied by the IMF's Research Department (Díez et al., 2018). The Orbis BvD database includes all companies that report to the business registry, and thus is considered as well-representing the business dynamics of the Spanish economy (Gopinath et al., 2017). Nevertheless, there could be an underrepresentation of the smaller firms as their self-reported information can be less accurate compared to large firms. These firms are also subject to lighter reporting standards which could result in more missing information. To ensure that business dynamics in our data sample are consistent with census, we select 10 economic sectors for which the database matches well both the sectoral employment and value-added growth from the National Statistical Office since early 2000s. These sectors include manufacturing, construction, wholesale and retail trade, transport, accommodation and food, ICT, professional and technical activities, education, health, entertainment, and other services. They cover about 80 percent of the total value added and 70 percent of total employment in the Spanish economy (see Annex I for details).

Empirical Strategy

6. To understand the factors that are relevant to firm investment, we include standard firm-level variables and other macroeconomic variables of our interest. The empirical model follows the standard specification for firm investment behaviors, which regresses firm-level investment on the above-mentioned variables (Gebauer et al., 2018; Dejuán and Ghirelli, 2018; etc.):

$$Inv_{it} = \beta_0 + \beta_1 Leverage_{i,t-1} + \beta_2 \log(Fixed\ asset_{it}) + \beta_3 DebtRatio_{it} + \beta_4 ROA_{it} + \beta_5 SalesGrowth_{i,t+1} + \gamma X_{it} + \kappa_{srt}$$

Firm net investment, Inv_{it}, is the change in fixed assets normalized by the one-year lagged value of fixed assets. The normalization allows the investment variable to be comparable between large and small firms. The normalized investment rate can also be interpreted as the percent change of firm capital stock. $Leverage_{it}$ and $DebtRatio_{it}$ represent the debt-to-asset ratio and the debt service ratio, respectively, which serve as proxies for firm balance sheet health. ROA_{it} and $SalesGrowth_{it}$ characterize the profits and sales growth, which indicate the performance of each firm. Conceptually,

[3] The data sample is an unbalanced panel with about 8 million total observations .

firms with higher leverage ratios and debt service ratios have more stressed balance sheets and find it more difficult to finance their investments. Firms with higher profits or future sales growth, on the contrary, should invest more. Finally, X_{it} includes other explanatory variables of interests, such as firm size, age, and local product market concentration; κ_{srt} is sector-region-year fixed effects.[4]

7. The construction of misallocation and TFP measures also follows the standard approaches in the literature.

a. **Misallocation.** A conventional measure of misallocation is the dispersion of firm-level return to capital, measured as the log marginal revenue product of capital (MRPK) and the return to labor, as measured by the log marginal revenue product of labor (MRPL). The two variables are derived from a growth accounting framework that has been widely used in the literature[5] (Hsieh and Klenow, 2009; Hsieh and Song, 2015; Gopinath et al. 2017), which solves each firm's profit maximization problem[6]:

$$\max_{p_{ist},k_{ist},l_{ist}} \pi_{ist} = p(y_{ist})y_{ist} - \left(1+\tau_{ist}^{K}\right)(r_t+\delta_{st})k_{ist} - \left(1+\tau_{ist}^{L}\right)w_{st}l_{ist}, \quad (1)$$

where $y_{ist} = A_{ist}k_{ist}^{\alpha}l_{ist}^{1-\alpha}$ is the production function of firm i. Standard first-order conditions equalize the marginal revenue product of capital (labor) to the cost of the production factor:

$$MRPL_{it} = \left({}^{(1-\alpha)}/_{\mu}\right)\left({}^{p(y_{ist})y_{ist}}/_{l_{ist}}\right) = \left(1+\tau_{ist}^{L}\right)w_{st}$$
$$MRPK_{it} = \left({}^{\alpha}/_{\mu}\right)\left({}^{p(y_{ist})y_{ist}}/_{k_{ist}}\right) = \left(1+\tau_{ist}^{K}\right)(r_t+\delta_{st}),$$

where $\tau_{ist}^{L}, \tau_{ist}^{K}$ are reduced-form measures of labor and capital market frictions, respectively. A higher τ implies that a firm pays a higher cost for the production factor, and therefore it faces more frictions in the factor market. Note that here we assume sector-specific factor prices, therefore the exercise only analyzes misallocation within each sector, but not across sectors.

b. **Firm-Level TFP.** The estimation of firm-level TFP is conducted by the IMF's Research Department. Since the Orbis BvD database provides information on material costs for Spanish firms, TFP is then estimated using the method proposed by De Loecker and Warzynski (2012), and also by Ackerberg, Caves, and Frazer (2015), and uses value-added on the left-hand-side.

[4] For a complete discussion of the construction of variables, see Annex II for details.

[5] The specification of the wedge parameter, τ, can be slightly different depending on whether the analyses focus more on the factors markets (capital, labor) or the product market. In this paper, we model the frictions in the capital market and the labor market following Hsieh and Song (2015).

[6] $\pi, p, y, r, \delta, k, w, l$ represent profit, output price, output, market interest rate, sector-specific depreciation, capital stock, and employment, respectively; i, s, t refer to firm, sector, and year.

8. Common explanatory variables for investment, misallocation, and TFP analyses are:

a. **Local Market Concentration.** We define a unique local product market for each pair of NACE 2-digit sector and autonomous communities. For example, all firms conducting manufacturing of machinery and equipment in Madrid are considered as in the same product market. A similar firm operating in Valencia, however, is considered as in a different market. There is a total of [209] local product markets based on this definition. We measure the concentration of each product market using the Herfindahl–Hirschman index (HHI), calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers.

b. **Firm Size.** This chapter adopts two different approaches to identify the size of each firm. The first approach follows the standard definition by relying on the number of employees: firms with 0–9 employees, 10–49 employees, 50–249 employees, and 250 employees or more are considered as micro, small, medium-sized, and large enterprises, respectively. The second approach defines the size of a firm based on its book value of fixed assets. We divide the sample into 4 quartiles and define firms from the lowest to the highest quartiles as micro, small, medium, and large firms.

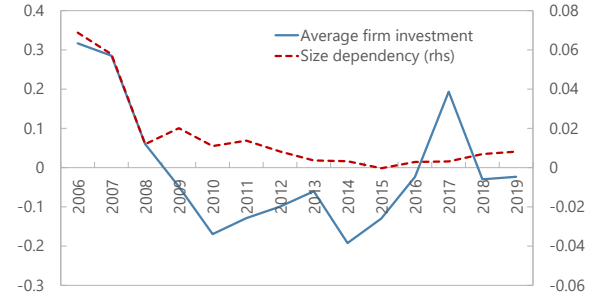
c. **Firm Age.** The age of a firm is calculated as the number of years since establishment. At establishment, the firm is considered as one year old.

C. Results

Firm-Level Investment

9. While firms generally invested less after the GFC amid a deleveraging process and tighter financial conditions, large firms were disproportionately more affected. Before the GFC, firm net investment rate, which can be also interpreted as the annual percent change of firm capital stock, averaged about 20 to 30 percent. It dropped to negative territory after the crisis and has only recently started to increase again. Besides, firm investment rate is typically positively correlated with firm size (measured by the total value of fixed assets): before the GFC, a 10-percent increase in firm asset value could raise investment rate by about 0.6 percentage points. This difference between large and small firms declined rapidly after the GFC: by 2015, there was almost no difference between the investment rates of large and small firms. Such a change in the size-dependency of firm investment over time turned out to be mainly driven by three financial market and policy variables—real interest rate, total deposits growth, and economic policy uncertainty. Large firms tend to disproportionally lower investment when the real interest rate increases, total deposit growth declines, and economic policy uncertainty rises. This result is consistent with recent findings in the literature that large companies are more sensitive to economic cycles in advanced economies (Cravo, 2017) and contributing the most to economic fluctuations (Crouzet and Mehrotra, 2020). It suggests that supporting systemic firms during economic downturns could help better sustain the investment potential of the business sector.

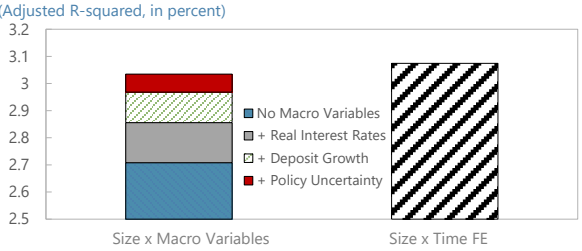
Firm Investment Rate: Average and Size Dependency



Sources: Orbis BVD Database and IMF staff calculations.
Note: Firm investment is normalized by 1-year lagged fixed asset value; size dependency of firm investment is computed by regressing investment on the log of fixed asset value - a coefficient of 0.05 implies that a 10-percent increase in firm asset value could raise investment rate by about 0.5 percentage points.

Size-Dependent Firm Investment and Macro Conditions

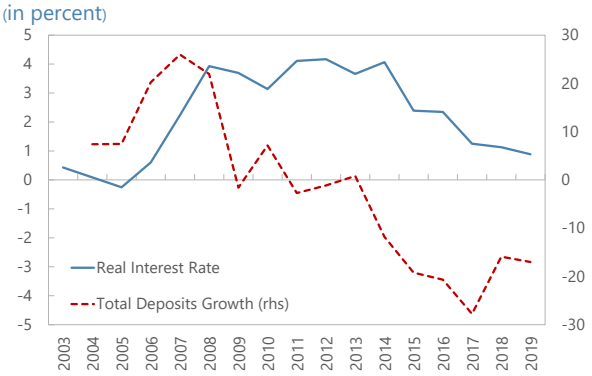
(Adjusted R-squared, in percent)



Sources: Orbis BvD Database and IMF staff calculations.
Note: The charts shows the adjusted R-squared of two different models, which are almost the same. The left bar shows the model with firm size intereacted with real interest rate, total deposits growth, and economic policy uncertainty. The right bar corresponds to the model that includes all possible macro-level shocks by controlling size cross year fixed effects. Firm size is measured using the logarithm of fixed asset value.

Macroeconomic Variables: Financial Market Indicators

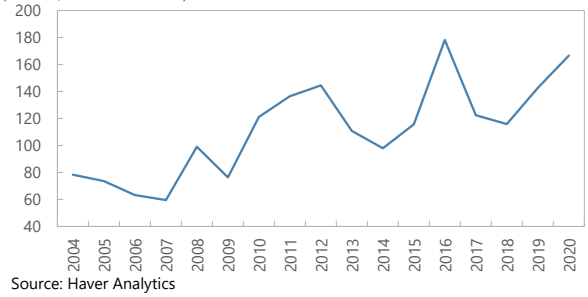
(in percent)



Sources: Bank of Spain, INE, Haver Analytics and IMF staff calculations.

Macroeconomic Variable: Economic Policy Uncertainty

(Index, Mean = 100)

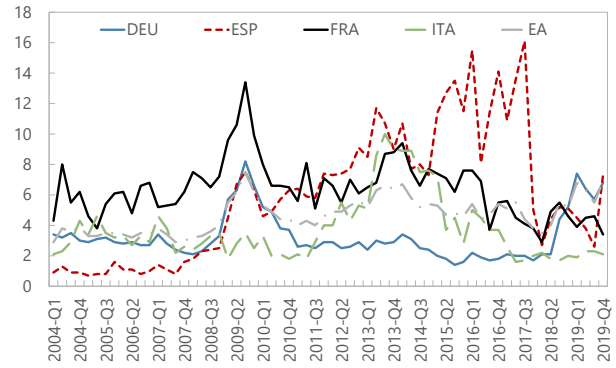


Source: Haver Analytics
Note: EPU index for Spain is developed by Corinna Ghirelli, Javier J. Pérez and Alberto Urtasun, based on newspaper coverage frequency of 7 relevant Spanish national newspapers from January 1997 to the present: El País, El Mundo, La Vanguardia, ABC, Expansión, Cinco Días, and El Economista.

10. Firm-level characteristics, such as balance sheet health and growth potentials, have also shown to be significant determinants for firm investment. Firms with healthier balance sheets, i.e., the ones with lower leverage ratios and debt service ratios, tend to invest more regardless of the business cycle. These two ratios are often used in the literature (IMF, 2015; Gebauer et al. 2018) as proxies for firm financing constraints—companies with higher leverage ratio and debt service ratio have more limited financing space to cope with any negative shocks. Our results validate the significance of firm financial constraints on investment decisions. Moreover, we find that the relevance of balance sheet stress increases when financial conditions are tighter,[7] and that it is the tangible capital investment that responds more strongly to changes in financial conditions. Finally, higher firm-level investment is also positively correlated with stronger future sales growth and return on asset.

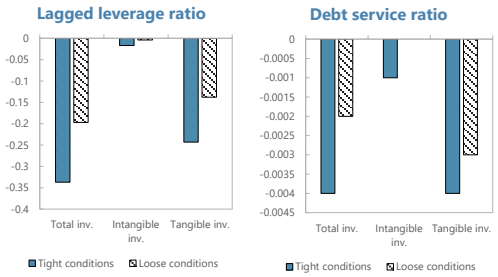
[7] Tighter financial conditions imply that real interests are higher and that the total deposits growth in the financial system is lower.

Factors Limiting Manufacturing Production: Financial Access
(Percent of surveyed firms)



Sources: European Commission Business and Consumer Survey.

Investment and Balance Sheet Health
(coefficients)



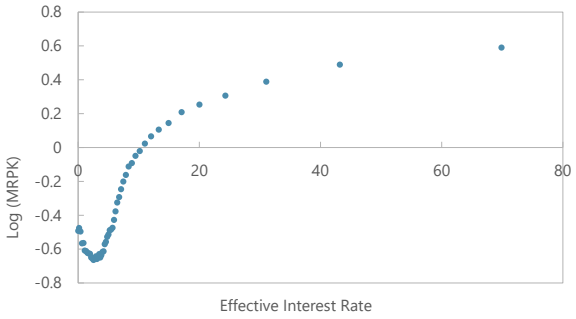
Sources: INE and IMF staff calculations.
Note: This chart shows the coefficients of regressing firm investment on proxies for financial constriants, controlling for other variables on firm performance and fixed effects. Financial conditions are decided using a combination of real interest rate and lending growth.

Resource Misallocation

11. Resource misallocation has been a long-standing candidate for explaining the productivity differences across countries. Although misallocation can happen in various forms, for this chapter we focus on how the allocation of a given amount of capital and labor across heterogeneous producers can be distorted (Restuccia and Rogerson, 2017). Following the firm optimization problem described in ¶7, each firm will increase the amount of its inputs until the marginal products of inputs equal the marginal costs. In a frictionless market, an efficient allocation of inputs that maximizes aggregate output will thus equalize the marginal products of labor and capital across all producers with the same costs. By examining the dispersion of firm marginal revenue products of capital (MRPK) and labor (MRPL), and the statistical correlation between these marginal products and firm characteristics, we could identify possible sources[8] of misallocation and discuss policy solutions to improve the allocative efficiency of production inputs. We also find significant and positive correlations between the model-based measure of cost of capital, MRPK, and observed indicators for financial constraints. For example, firms that have a higher MRPK also pay a higher level of effective interest rate, and hold on average a larger share of intangible assets. For the rest of this chapter, we use the marginal revenue product of capital (labor) and the marginal cost of capital (labor) interchangeably.

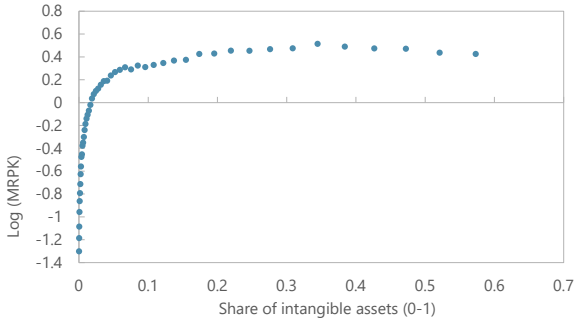
[8] Common drivers of misallocation that have been discussed in the literature include tax and labor regulations, discretionary governance or credit provision, imperfect competition in the capital, labor, and product markets, etc. (Restuccia and Rogerson, 2017).

Marginal Cost of Capital (MRPK) and Effecitve Interest Rate



Sources: Orbis BvD database and IMF staff calculations.
Note: The data sample is divided into 50 equal bins based on the estimated effective interest rate. For each bin, the chart shows the median effecitve interest rate and the median value of log(MRPK).

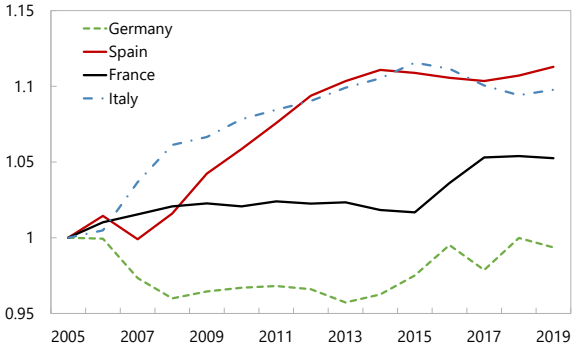
Marginal Cost of Capital (MRPK) and Intangible Assets



Sources: Orbis BvD database and IMF staff calculations.
Note: The data sample is divided into 50 equal bins based on the share of intangible assets, ranging from 0 to 1. For each bin, the chart shows the median intangible asset share and the median value of log(MRPK).

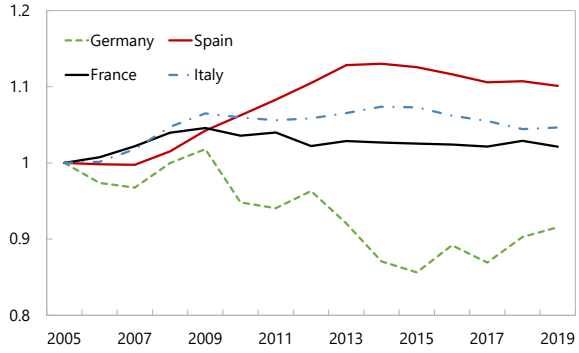
12. The within-sector allocative efficiency in Spain's capital market has stabilized in recent years, consistent with rising TFP. Nevertheless, Spain remains more inefficient relative to early 2000s compared to more productive countries in the region such as France and Germany.[9] The stabilization of capital misallocation in recent years (Moral-Benito and Fu, 2015; García-Santana et al., 2020) could partly be associated with the "cleansing effect" of credit contractions (Osotimehin and Pappadà, 2017), as bank lending declines. Research has also pointed to the positive impact of accommodative monetary policy on improving allocative efficiency (Albrizio et al., 2021). The still-elevated level of misallocation implies a large variation in firms' marginal productivity of capital. Firms showing a higher level[10] of marginal product of capital are facing a larger financing cost, and thus are more financially constrained. For the remainder of this section, we focus on understanding the allocative efficiency along two observable dimensions, firm size and age, and empirically test if there exist clear distortions in the capital market.

Dispersion of Marginal Revenue Product of Capital (MRPK)
(whole sample, 2005 = 1)



Sources: Orbis BvD dabase and IMF staff calculations.

Dispersion of Marginal Revenue Product of Capital (MRPK)
(manufacturing sector, 2005 = 1)



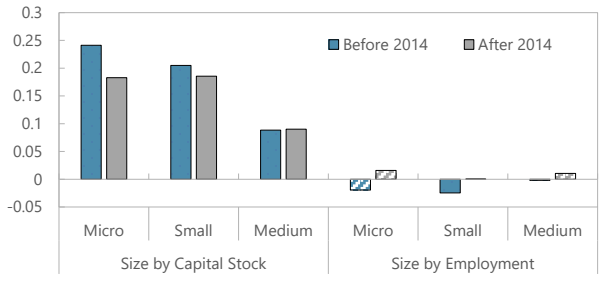
Sources: Orbis BvD database and IMF staff calculations.

[9] This exercise fixes the sectoral share of gross value added at its initial level and normalizes MRPK dispersion in 2005 as 1 for all countries. A potential caveat of the exercise is that although the Orbis BvD database is relatively representative for Spain, it could be less representative for other countries. In the comparison chart, we show results starting 2005 to avoid any big jumps in sample coverage. In addition, the comparison for manufacturing firms is consistent with the one discussed in Gopinath et al. (2017).

[10] After controlling for aggregate financial market conditions and the specifics of each industry.

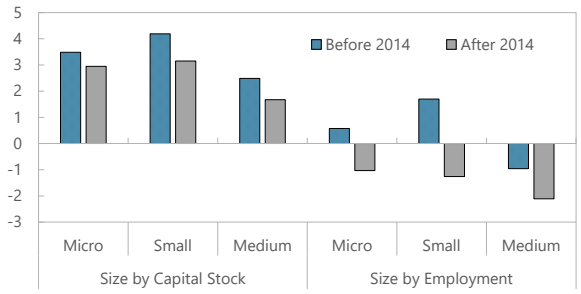
13. Firms with lower fixed assets are subject to higher financing costs. Small and medium-sized enterprises (SMEs) are usually considered as having more difficulties in accessing external financial sources. However, what is often neglected in the discussion is the relevant criteria in classifying firm size, which can include employment, revenue, asset value, etc. In official statistics, SMEs are usually defined based on employment and revenue (European Commission, 2003). We find that the relevant criteria for capital market distortions is the level of capital stock, measured as the total value of fixed assets. Micro, small, and medium-sized firms defined based on fixed asset value pay a higher cost of capital compared to large firms, both before the euro area crisis and in recent years. This finding is consistent with the literature emphasizing the importance of collateral constraint (the maximum amount of external financing is determined by the value of firms' existing capital stock) for scaling up production. Firm size measured by employment, on the contrary, does not show a robust correlation with the cost of external financing. As a robustness check, we also find that firms with less capital stock on average pay higher effective interest rates, which can serve as a proxy for average borrowing cost.

Firm Marginal Cost of Capital Across Different Sizes
(in log differences)



Sources: Orbis BvD Database and IMF staff calculations.
Note: The chart shows the difference relative to the group of large firms, controlling for firm-specific characteristics and region-industry-year fixed effects. The shaded bars imply that the differences are statistically insignificant.

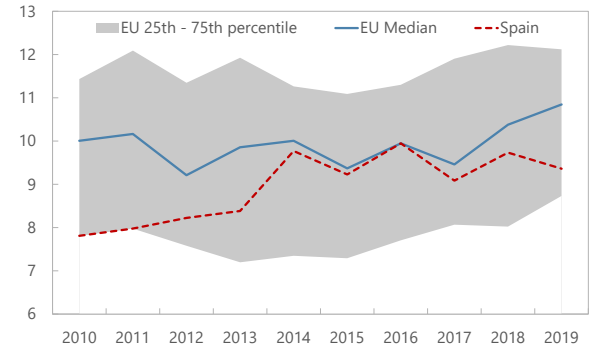
Firm Effective Interest Rate Across Different Sizes
(in percentage points)



Sources: Orbis BvD Database and IMF staff calculations.
Note: The chart shows the difference relative to the group of large firms, controlling for firm-specific characteristics and region-industry-year fixed effects.

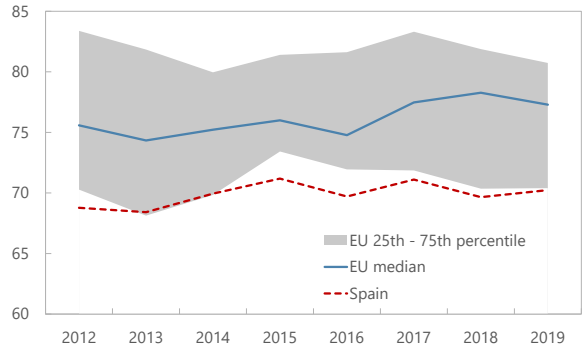
14. Start-ups with an age of less than two years also face significantly higher frictions in the capital market. Compared to EU peers, Spain's business sector tends to have lower entry rates and lower post-entry survival rates, suggesting that the young firms face significant barriers not only in entering the market but also in maintaining their businesses. Although the gaps in entry rates and the survival rate within the first two years have been declining before 2015, they became larger again in recent years. Another interesting finding is that Spanish firms seem to be facing a tougher environment only in the first two years—conditional on surviving after 2 years, the probability of surviving within 3 to 5 years is larger in Spain than in a median EU country. In addition, only firms that are 1 or 2 years old seem to be facing significantly higher cost of capital compared to established firms with 10 or more years of experience. Therefore, policies should focus on supporting startups to help them survive through the first two years.

New Entrants
(in percent of active enterprises)



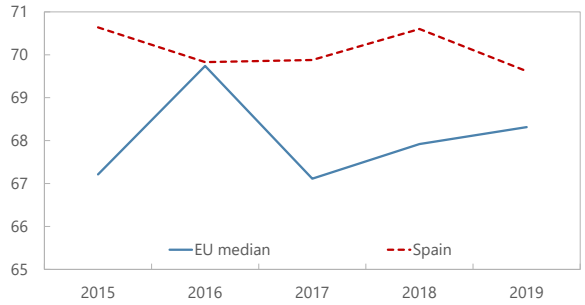
Sources: Eurostat Business Demography Database and IMF staff calculations.

Survival Rates Within the First Two Years
(in percent of total entrants within the past 2 years)



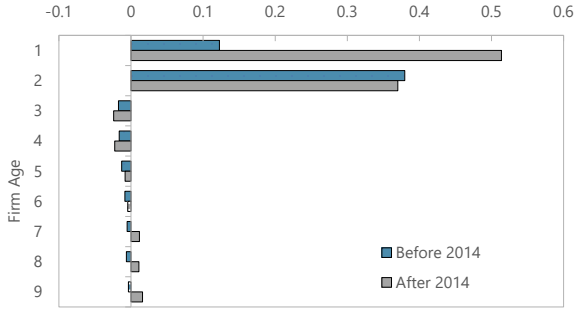
Sources: Eurostat Business Demography Database and IMF staff calculations.

Conditional Survival Rate: 3 to 5 Years After Birth
(in percent of the number of enterprises survived after 2 years)



Sources: Eurostat Business Demography Database and IMF staff calculations.
Note: The conditional survival rate is computed as the ratio of the probability of surviving in 3-5 years over the probability of surviving after two years.

Firm Marginal Cost of Capital and Age
(in log differences)



Sources: Orbis BvD Database and IMF staff calculations.
Note: The chart shows the difference relative to the group of firms with 10 or more years of experience, controlling for firm-specifica characteristics.

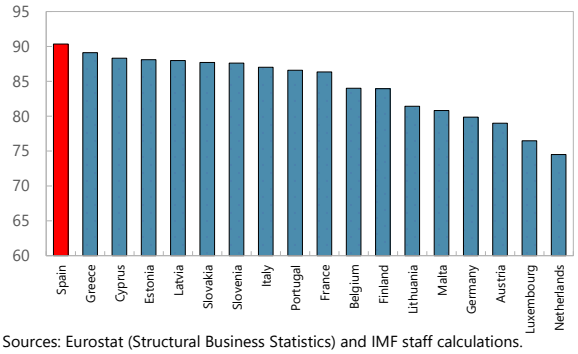
15. In addition to capital market imperfections, misallocation could arise due to the large number of size-dependent regulations in Spain. The prevalence of small and micro firms is high in Spain compared to other European countries, and it is one of the factors that explains Spain's low aggregate productivity, since SMEs have on average significantly lower TFP compared to large firms. Size related rules and regulations can potentially create a "small business trap" (IMF Country Report, 2018; CEPYME, 2021). More than 100 size related regulations are present in Spain, ranging from accounting, financial, insurance, labor, to tax areas. These have created advantages for small business but could have also reduced incentives to grow and created inefficiencies. For example, firms with less than 10 employees and with 10–49 employees have less responsibilities in forming a workplace representation, which could imply a lower cost of labor from the firms' perspectives. Using the growth accounting framework in ¶7, we also find that firms with less than 10 employees and with 10–49 employees pay less for labor, which could imply size-related misallocations in the labor market

Examples of Size-Dependent Regulations

	Labor	Accounting 1/	Tax
>= 10 employees	Employees have the right to elect representatives with 15 hours per month paid	Not eligible for simplified accounting if the company has either 1) assets of more than EUR 1 mn or 2) sales of more than EUR 2 mn	Monthly VAT and income tax retention settlement if company has sales over EUR 6mn.
>= 50 employees	The employee representatives are elected as members of a works council (comité de empresa)	Not eligible for simplified balance sheets if the company has either 1) assets of more than EUR 4mn or 2) sales of more than EUR 8mn	

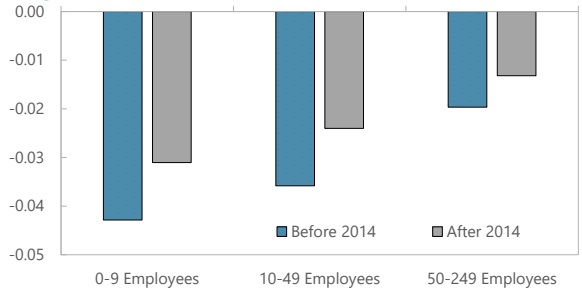
Source: CEPYME.
1/ The accounting regulations would apply if companies meet both conditions related to assets and sales, regardless of its total number of employees.

Euro Area: Share of Firms with 1-9 Employees
(in percent of total enterprises, 2019)



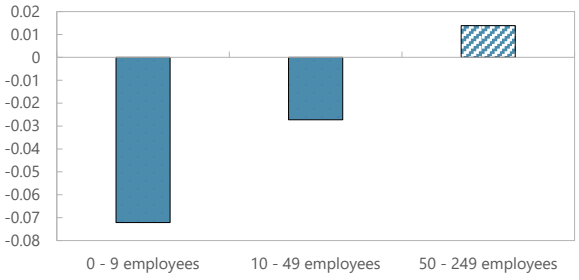
Sources: Eurostat (Structural Business Statistics) and IMF staff calculations.
Note: Ireland is not included due to data availability.

Total Factor Productivity (TFP) and Firm Size
(in log differences)



Sources: Orbis BvD database and IMF staff calculations.
Note: The chart shows the difference relative to the group of large firms with 250 or more employees, controlling for firm-specific characteristics and region-industry-year fixed effects.

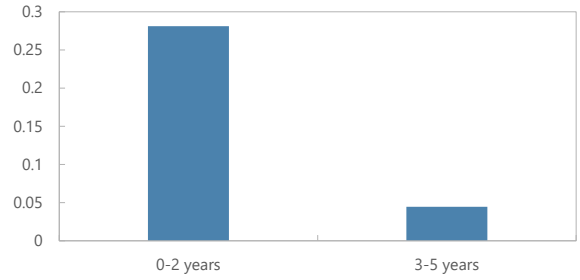
Firm Marginal Cost of Labor Across Different Sizes
(in log differences)



Sources: Orbis BvD Database and IMF staff calculations.
Note: The chart shows the difference relative to the group of firms with 250 or more employees, controlling for firm-specific characteristics. The shaded bars imply that the differences are statistically insignificant.

16. The long-standing structural challenges in the labor market can be another source of inefficiency preventing more efficient allocation of the workforce, particularly for the young firms. Dolado et al. (2011) found that across different sectors, young firms in general use a larger share of temporary contracts, which also implies a higher risk of employment instability for these firms. This can be rationalized by the fact that newer firms are forced to make a more widespread use of flexible temporary contracts for precautionary reasons. In addition, young firms could face higher labor search costs compared to established franchises (Minkler, 1992). Finally, the rigidity in the labor market could also have prevented these young firms from expanding their production to the desirable scale. Using the growth accounting framework, we verify again that startups (with an age of less than 2 years) and young firms (with an age of 3–5 years) have a higher labor wedge, suggesting more distortions facing

Firm Marginal Cost of Labor Across Age Groups
(in log differences)



Sources: Orbis BvD Database and IMF staff calculations.
Note: The chart shows the difference relative to the group of firms 6 or more years of experience, controlling for firm-specific characteristics. The shaded bars imply that the differences are statistically insignificant.

them also in the labor market. Therefore, supports to startups could consider including non-monetary measures such as promoting employee ownership and facilitating startup spin-offs from science and universities (Comprehensive startup strategy, Germany). Spain has recently modified its labor regulation to promote the use of permanent contracts rather than temporary ones. Since the implementation of the reform, there has been a significant increase in the share of permanent contracts, but it is still too early to make a full assessment. The new legal framework has also strengthened short-time work schemes to provide flexibility to firms facing shocks. These changes could have a positive impact on workforce allocation, including across young firms.

Other Drivers of TFP

17. Product market competition, which has been affected by the regional dispersion of regulatory frameworks, could also have an impact both firm-level TFP and investment. Spain approved the Market Unity Law in 2013, which aimed to align regulatory requirements by the central, regional, and local authorities. Nevertheless, the application of the Market Unity Law remains slow due to the null and void declaration of key principals by the Spanish Constitutional Court in 2017, and as a result, regulatory differences across autonomous communities and municipalities have not improved materially. A recent study by Llano-Verduras et al. (2021) found that fragmentation of the Spanish market has been increasing since the GFC, and that sub-national regulations have been significant contributors. An earlier study by the IMF (IMF, 2015) has stated the importance of product market competition on firm-level TFP by exploring cross-industry variations in ex-ante regulation stringency. Based on an ex-post measure of local market concentration (¶8), we find that a more competitive local product market implies both higher investment and higher TFP at the firm level. This finding is consistent with the literature finding (Gutiérrez and Philippon, 2017; IMF, 2019) that increases in the market power of already-powerful firms could weaken investment, deter innovation, and reduce labor income shares.

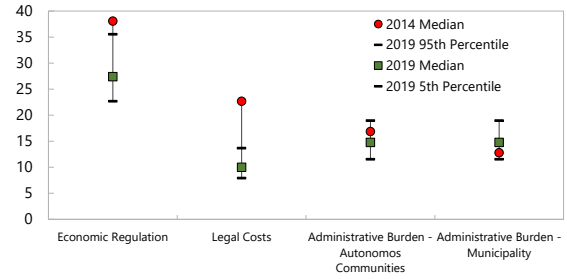
Importance of the Factors in Firm Growth: 2015 vs 2019

(in percent)

	Total		Industry		Construction		Trade		Transport		Other Services	
	2015	2019	2015	2019	2015	2019	2015	2019	2015	2019	2015	2019
Product demand	44.4	40.52	54.3	49.6	43.8	32.04	43.7	41.24	35.9	36.77	43.4	39.61
Macroeconomic environment	24.4	24.76	31.1	31.13	22.5	16.83	17.3	19.65	16.8	21.73	28.5	27.71
Economic regulation	19.7	23.82	18.3	21.76	20.1	19.25	14.9	18.35	11.1	20.62	26	30.03
Taxation	17.9	17.97	17.4	14.97	20.8	26.7	17	12.54	9.2	13.79	20.8	21.03
Default	13.9	5.14	13.4	1.89	22.8	19.74	5.3	-3.04	-6.3	-9.75	23.2	11.66
Availability of financing	13.5	4.08	14.7	5.19	29.5	16.67	7	-0.19	6.9	-0.97	14	3.79
Efficiency of the job market	7.6	14.1	7	10.58	7.6	14.24	3.5	7.19	3.4	15.19	11.6	18.9
Adaptation of human capital	1.1	11.3	5.1	10.28	-4.4	11.98	-4	1.85	-5	10.58	5.6	16.67
Input costs	-5.2	-4.55	13.1	13.47	-8.3	-1.46	-6	-6.18	-6.2	-7.8	-11.9	-12.08
Infrastructures	-11.6	-7.63	-4.8	-2.1	-7.7	-1.3	-12.5	-13.29	-6.6	4.04	-17.1	-13.17
Insufficient equipment	-17.1	-14.84	-4	-9.59	-18.9	-13.75	-21.8	-20.57	-15.8	-9.47	-20.6	-16.53
Legal costs	-33.3	-35.62	-38.8	-43.51	-31.5	-30.58	-38	-43.36	-41.9	-44.16	-25.8	-26.48

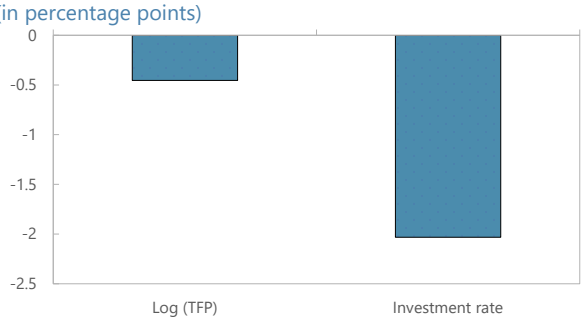
Note: Data drawn from the module devoted to opinion on the business environment, of the INE business confidence index. It represents the difference between the percentage of firms giving a high importance to those factors and the percentage of firms giving them a low importance.

Regulatory Barriers: Regional Distribution
(in percent)



Source: INE Business Confidence Indicators.
Note: "Economic Regulation" and "Legal Costs" report the share of surveyed firms identifying these two areas as unfavourable; "Administrative Burden" report the share of firms identifying increased burden related to paperwork.

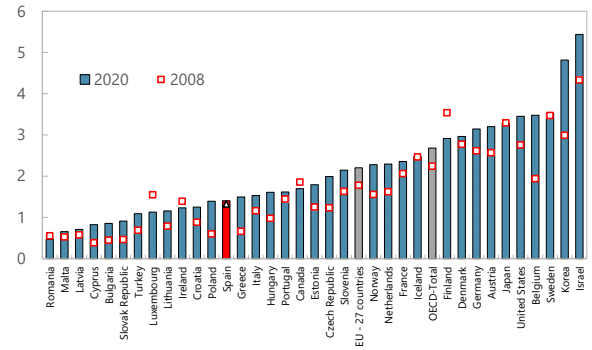
Produce Market Concentration, Investment, and TFP
(in percentage points)



Sources: Orbis BvD database and IMF staff calculations.
Note: The chart shows the coefficients of regressing firm-level log TFP and investment rate on local market Herfindahl–Hirschman index (HHI). The chart shows the impact of HHI changing from 0 to 1.

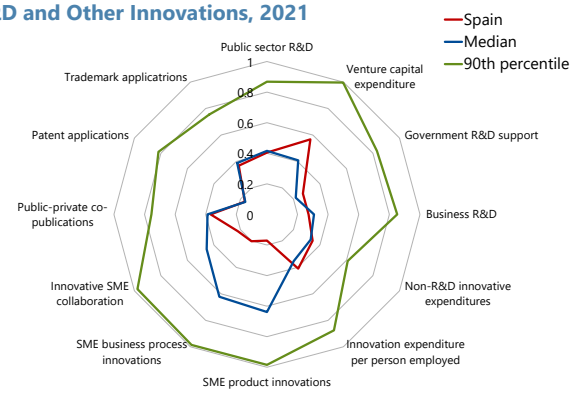
18. Spain continues to rank relatively low in business innovation, which can be critical for productivity growth. Business research and development (R&D) spending in Spain as a share of GDP lags European and OECD peers and it has not increased materially since 2008. Despite the relatively high implied tax subsidy rate for R&D activities, the take-up rate of R&D tax incentives has been limited in the past. Overall government support of business R&D (both direct and indirect) fall short compared to the frontier of the region (OECD, 2021). The number of firms conducting R&D activities and the number receiving R&D tax reliefs have both been declining in recent years (Xifré, 2018; OECD, 2021). In addition to R&D, Spanish businesses also lag in terms of other innovative activities, including business and public-private collaborations, process innovations, and business non-R&D innovative expenditures.

OECD: R&D Intensity
(in percent of GDP)



Sources: OECD Main Science and Technology Indicators.

R&D and Other Innovations, 2021

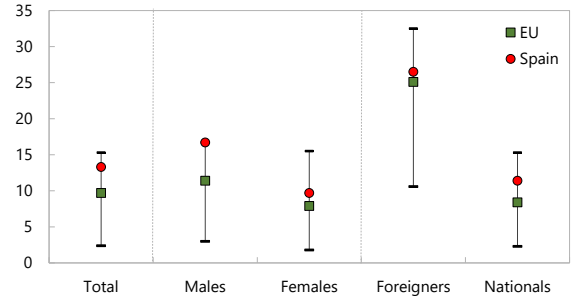


Source: European Commission - European Innovation Scoreboard.

19. Increasing the educational attainment level of workers and employers is crucial to boosting productivity. Despite a 13-percentage point decline over the last decade, the rate of early leavers from education and training (age 18–24) in Spain is still among the highest in Europe. In addition, enrollment in vocational education and training (VET) remains low compared to the region. The structural transformation of the economy, including digitalization and greening, is expected to

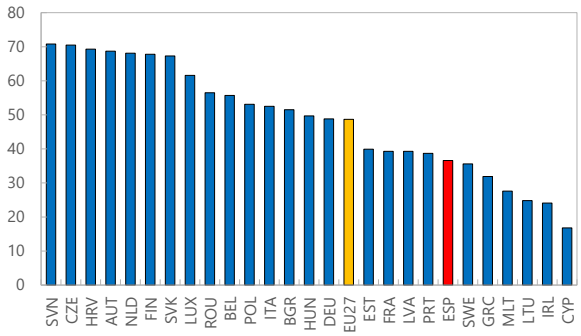
raise demand on certain skills, such as communication & creation, and information skills (IMF, 2022 Selected Issues). An ageing population also requires emphasis on learning and re-skilling throughout employees' work lives. Recent reforms to the vocational and training system and the introduction of incentives for the provision of training are aligned with this objective. The reforms to active labor market policies included in the RTRP also aim at promoting learning and re-skilling throughout employees' work lives by creating personalized itineraries for low employability groups, with focus on those skills most demanded by the market.

Early Leavers From Education and Training
(Percent of total 18-24 population; 2021)



Source: Eurostat and IMF staff calculations.
Note: "Early leavers" are persons aged 18-24 who have attained at most lower secondary education and have not being involved in further education or training.

Share of Upper Secondary Students in VET Programs
(Percent of total students enrolled in upper secondary education; 2020)



Sources: Eurostat and IMF staff calculations.
VET = Vocational Education and Training

D. Recent Policies to Promote Productivity Growth

20. Spain has committed to undertake ambitious reforms as part of its recovery plan. These initiatives cover areas that are key determinants of productivity, as discussed in the previous sections. While the plan identifies the right priorities, its success will ultimately depend on design and implementation details.

Area	Key Initiatives
Human Capital	Labor reform to address duality, education law, digital skills
R&D	PERTEs, Law on science, technology, and information, target 2 percent of GDP in R&D investment
Business demographics and dynamics	Law on business creation and growth, Startup law, sectoral conference on better regulation and business climate, insolvency reform

- ***Human Capital.*** One of the main objectives of the labor reform enacted in 2022 was to combat the high prevalence of temporary employment, which hinders the accumulation of workers' human capital. While it is still too early to assess the impact of the reform, initial data suggests that the proportion of permanent hires has increased significantly. The recovery plan also includes ambitious education reforms to help boost human capital, including investments in digital skills, expansion of vocational training, modernization of the education system and revamp active labor market policies (which is important to limit the loss of human capital during unemployment). It will be important to evaluate the effectiveness of the new programs once they have been in place for some time.

- ***Innovation.*** The recently approved Law on Science, Technology and Innovation sets a goal for R&D public funding of 1.25 percent of GDP by 2030 (3 percent including private investment). The plan to increase budgetary support for R&D and innovation is welcome but should be complemented with a review of the existing incentives framework. Further efforts are needed to strengthen collaborations between the public and private sectors and identify impediments to business innovation. The adoption of large strategic projects (PERTEs) provides a good opportunity to work on the synergies between public and private investment and foster innovation.

21. There are several ongoing initiatives to improve business dynamics. The recently approved Law on Business Growth includes measures to eliminate financial and administrative barriers to firm growth and to reduce delinquency rates. A new Start-up Law is also being legislated to provide incentives and facilitate the creation of innovative companies. The new sectoral conference for Regulatory Improvement and the Business Climate, established in 2021, aims at enhancing cooperation and sharing of best practices among different levels of the government to foster business activity. Further efforts should focus on reviewing size-dependent regulatory thresholds in the labor and tax spheres (which may be discouraging business growth), and better aligning the regulatory framework across regional and local authorities to promote market integration and business competition.

E. Conclusion

22. This chapter studies the development and drivers of labor productivity in Spain using both macro and firm-level data. The low labor productivity growth in recent years was mostly driven by a lack of capital deepening because of weak firm investment, amid a continued deleveraging process since the GFC. The analysis finds that large firms lowered investment disproportionally more in response to the unfavorable macroeconomic shock, and that firm balance sheet health and growth potential are significant factors affecting investment decisions. Moreover, allocative inefficiency remains relatively high in Spain compared to neighboring countries. Misallocation across firms' size and age groups is identified both in the capital market and in the labor market (based on different measures of firm size). This suggests that financial frictions due to size-dependent financial constraints remain a significant determinant of TFP. In addition, the size-dependent labor regulations (and possibly other regulations, including in the areas of tax and accounting) could have disincentivized a more efficient allocation of workers. Startups with less than 2 years of experience are the most vulnerable age group, which show a much lower survival rate compared to other European countries and significant disadvantages in both the capital and the labor market compared to older firms. Finally, the analysis finds that high market concentration is associated with both weak investment and weak TFP growth.

23. Safeguarding firm balance sheets and supporting large and systemic companies during downturns could help limit the impact of negative macroeconomic shocks on investment. Firm support measures taken during the pandemic, including the state-backed guarantee program and the solvency support to strategic companies and other businesses affected by COVID have successfully preserved the environment for resuming corporate investment.

Reducing economic policy uncertainty and reforms in product market regulation would also help boost investment. Public investment in large strategic projects (PERTEs), and effective implementation of structural reforms, could crowd in private investment in tangible as well as intangible capital (Alloza et al., 2022).

24. Further efforts on improving the allocative efficiency of production factors could enhance firm TFP growth. The several initiatives planned in the context of Spain's recovery plan go in the right direction. Going forward, continued policy effort is needed to alleviate distortions faced by startups and SMEs. These include: improving access to finance for disadvantaged firms (e.g. startup with less than two years of experience or firms with limited physical capital to use as collaterals), reviewing the large number of size-related rules and regulations, and expanding non-monetary support to startups (including facilitating the search for talent, providing easier access to data, and reducing regulatory costs). Continued work on aligning the regional regulatory framework and improving product market competition is also warranted.

References

Ackerberg, D., Caves, K., & Frazer, G. (2015). *Indentification Properties of Recent Production Function Estimators.* Econometrica.

Albrizio, S., González, B., & Khametshin, D. (2021). *A Tale of Two Margins: Monetary Policy and Capital Misallocation in Spain.* Working paper.

Alloza, M., Leiva-León, D., & Urtasun, A. (2022). *The Response of Private Investment to an Increase in Public Investment.* Bank of Spain, Economic Bulletin.

Almunia, M., & Lopez-Rodriguez, D. (2018). *Under the Radar: the Effects of Monitoring Firms on Tax Compliance.* American Economic Journal: Economic Policy.

Andrews, D., Cingano, F., & Conconi, P. (2014). *Public policy and resource allocation: evidence from firms in OECD countries.* Economic Policy.

Bank of Spain. (2015). *Annual Report: Business Dynamics in Spain.* Bank of Spain.

BMWK. (2022). *Start-up-Strategie der Bundesregierung.* Bundesministerium für Wirtschaft und Klimaschutz (BMWK).

CEPYME. (2021). *Improving Business Situation of SMEs in Spain.* CEPYME.

Cravo, T. (2017). *Firm Size and Business Cycles.* Institute for the Study of Labor (IZA).

Crouzet, N., & Mehrotra, N. (2020). *Small and Large Firms over the Business Cycle.* American Economic Review.

De Loecker, J., & Warzynski, F. (2012). *Markups and Firm-level Export Status.* American Economic Review.

Dejuán, D., & Ghirelli, C. (2018). *Policy Uncertainty and Investment in Spain.* Bank of Spain.

Díez, F., Fan, J., & Sanchez-Villegas, C. (2018). *RES-Orbis Dataset: Cleaning Procedure and TFP Estimation.* International Monetary Fund.

European Commission. (2003). *Commission Recomendation of 6 May 2003 Concerning the Definition of Micro, Small, and Medium-sized Enterprises.* European Commission.

Fu, C., & Moral-Benito, E. (2018). *The Evolution of Spanish Total Factor Productivity since the Global Financial Crisis.* Bank of Spain.

García-Santana, M., Moral-Benito, E., Pijoan-Mas, J., & Ramos, R. (2020). *Growing Like Spain: 1995-2007.* International Economic Review.

Gebauer, S., Setzer, R., & Westphal, A. (2018). *Corporate Debt and Investment: A Firm-level Analysis for Stressed Euro Area Countries.* Journal of International Money and Finance.

Gopinath, G., Kalemli-Özcan, Ş., Karabarbounis, L., & Villegas-Sanchez, C. (2017). *Capital Allocation and Productivity in South Europe.* Quarterly Journal of Economics.

Gutiérrez, G., & Philippon, T. (2017). *Declining Competition and Investment in the US.* NBER Working Paper No.23583.

Hospido, L., & Moreno-Galbis, E. (2015). *The Spanish Productivity Puzzle in the Great Recession*. Madrid: Bank of Spain.

Hsieh, C.-T., & Klenow, P. (2009). *Misallocation and Manufacturing TFP in China and India*. Quarterly Journal of Economics.

Hsieh, C.-T., & Zheng, S. (2015). *Grasp the Large, Let Go of the Small: The Transformation of the State Sector in China*. Brookings Papers.

IMF. (2015). *Spain: Selected Issues*. International Monetary Fund.

IMF. (2018). *IMF Country Report 18/330: Spain 2018 Artical IV Staff Report*. International Monetary Fund.

IMF. (2018). *Spain: Selected Issues*. International Monetary Fund.

IMF. (2019). *The Rise of Corporate Market Power and its Macroeconomic Effects*. IMF World Economic Outlook.

Llano-Verduras, C., Pérez-Balsalobre, S., & Rincón-Aznar, A. (2021). *Market Fragmentation and the Rise of Sub-national Regulation*. The Annals of Regional Science.

Minkler, A. (1992). *Why Firms Franchise: A Search Cost theory*. Journal of Institutional and Theoretical Economics.

OECD. (2021). *R&D Tax Incentives: Spain, 2021*. OECD.

Osotimehin, S., & Pappadà, F. (2015). *Credit Frictions and the Cleansing Effect of Recessions*. The Economic Journal.

Restuccia, D., & Rogerson, R. (2017). *The Causes and Costs of Misallocation*. Journal of Economic Perspectives.

Xifré, R. (2018). *Spanish Investment in R&D+I in the Wake of the Crisis: Public versus Private Sector*. Spanish Economic and Financial Outlook.

Annex I. Data Coverage and Sample Selection

The table below summarizes the comparison of sectoral value added and wage bills between 2019 and 2003 in both the Orbis BvD database and in Eurostat. The 10 sectors selected for our firm-level analysis also show similar dynamics in the developments of the two variables from the two data sources, but they are not shown in the annex due to space limits.

Annex Table I.1. Spain: Sectoral Value Added and Wage Bills

		Eurostat (2019 over 2003)		Orbis BvD (2019 over 2003)	
NACE 1-digit Sector	No. of Observations	Value Added	Wage Bills	Value Added	Wage Bills
Manufacturing	1,240,793	1.12	1.01	0.94	0.93
Construction	1,654,263	0.81	0.74	0.58	0.72
Wholesale and retail trade; repair of motor vehicles and motorcycles	2,514,824	1.56	1.49	1.11	1.18
Transporting and storage	398,805	1.44	1.49	1.60	1.40
Accommodation and food service activities	614,057	1.37	1.65	1.53	1.51
Information and communication	278,940	1.22	1.53	1.09	1.30
Professional, scientific and technical activities	978,172	1.94	2.22	1.47	1.47
Education	137,630	1.51	1.56	1.90	1.91
Human health and social work activities	216,716	1.86	1.93	2.01	1.96
Arts, entertainment and recreation	164,213	1.82	1.66	1.78	1.97
Other services activities	156,871	2.06	1.87	1.77	1.49

Note: The table shows the ratios of the nominal value of 2019 value added and wage bills over the relevant nominal value in 2003, from both the Orbis sample and macro statistics in Eurostat.

Annex II. Definition of Variables and Summary Statistics

Variable Definition (additional)

Net investment rate, Inv_{it}: the change in the value of fixed assets, divided by the total capital stock (1-year lagged value of fixed assets).

Leverage ratio, $Leverage_{it}$: total outstanding debt minus cash and its equivalents, divided by total assets.

Debt service ratio, $DebtRatio_{it}$: interest payments plus financial costs divided by gross operating revenue plus gross financial revenue.

Sales growth rate, $SalesGrowth_{it}$: the percent change of sales revenue relative to the previous year. The variable takes a value of zero if firm sales are zero in two subsequent years.

Return on asset, ROA_{it}: sum of gross operating revenue plus gross financial revenue minus financial costs and interest payments, divided by total assets.

Summary Statistics

Annex Table II.1. Spain: Descriptive Statistics, Full Sample

Variable	No. of Observations	Mean	Std. dev.	1st Percentile	99th Percentile
Net Investment Rate	6,542,441	0.32	1.75	-1.0	13.6
Leverage Ratio	5,177,887	0.3	0.3	0.0	1.7
Log(Fixed Assets)	7,719,755	11.5	2.1	6.0	16.6
Debt Service Ratio	5,846,711	0.3	1.1	-4.8	6.6
ROA	8,055,687	0.0	0.2	-1.4	0.7
Age	8,062,505	13.5	9.2	2	45
EMPL	6,694,141	9.6	18.1	1	131
Market Share (percent)	7,850,550	0.2	2.2	0	100
Effective Interest Rate (percent)	4,022,777	8.6	12.4	0.0	100
TFP Growth (percent)	4,066,854	-0.3	14.1	-51.6	51.8
Sales Growth (percent)	7,024,140	24.4	125.3	-90.7	935.5
HHI (0-1)	8,065,049	0.05	0.11	0	1

Note: All the variables are winsorized to eliminate the impacts from the bottom and top 1 percent. Observations with effective interest rate higher than 100 percent are also excluded.

LABOR MARKET IMPLICATIONS OF GREEN INVESTMENTS AND CARBON PRICING IN SPAIN[1]

We provide a tractable framework for assessing the labor market impact of policies that support the green transition of the Spanish economy, taking into account input-output linkages. We present illustrative examples that quantify changes in sectoral employment, occupations and skills stemming from two different green policies: (i) the announced green investments in the recovery plan; and (ii) an increase in carbon pricing and an expansion of the EU Emission Trading System (ETS). Our analysis shows that the labor market impact of these two policies is net positive, although the results depend on the design of the green policies, particularly on the use of the proceeds from the increase in carbon pricing. Strengthening active labor market policies, with a focus on training, and complementing them with education policies such as the expansion of vocational training, would facilitate the transition of workers from shrinking to expanding sectors.

A. Green Policies in Spain[2]

1. Spain has set ambitious climate mitigation objectives. Spain's Law on Climate Change and the Energy Transition, enacted in 2021, establishes the goal of climate neutrality by 2050 at the latest, when the Spanish electricity system must be 100 percent renewable. Furthermore, the Law includes an intermediate target to reduce emissions by 23 percent relative to 1990 levels by 2030, as well as targets for 2030 for renewables to account for 42 percent of the country's energy mix, to generate 74 percent of its electricity (on a primary energy basis), and to reduce primary energy consumption by at least 39.5 percent by 2030.[3]

2. Achieving these objectives will require significant policy efforts in the coming years. The country's mitigation policies over the coming decade are guided by the National Integrated Energy and Climate Plan 2021–2030 (NECP). The Plan outlines sectoral actions necessary to meet the 2030 objectives. It envisages increasing renewable power installations and boosting the use of renewable gases in the power sector, modal shifts and electrification in the transport sector, refurbishments and increasing the use of renewable heating in the residential and commercial sectors, promoting energy efficiency and fuel switching in the industry sector, and energy efficiency improvements in the agricultural sector. The 2030 plan is complemented by a Just Transition Strategy to anticipate and manage the social implications of the ecological transition, and a Long-Term Strategy 2050 to ensure continuity in mitigations efforts beyond 2030.

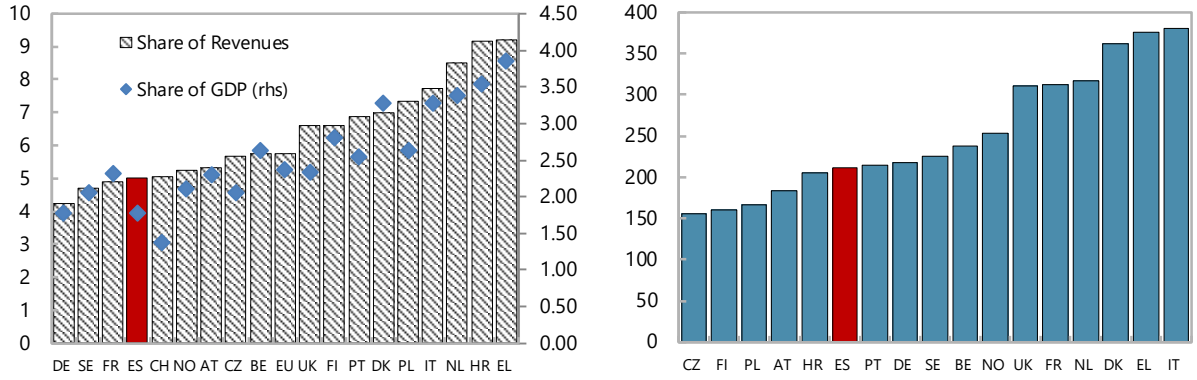
[1] Prepared by Ana Lariau and Yu Shi (both EUR).

[2] This section is based on Spain: 2021 Selected Issues.

[3] In addition to the specified targets, Spain's climate law establishes specific policies, such as that no later than 2040 new passenger cars and light commercial vehicles will be vehicles with emissions of 0gCO2/km, and the establishment of low emission zones in urban centers with a population of at least 50 thousand by 2023. The law also strengthens the climate policy framework, with the creation of an Expert Committee tasked with submitting an annual report to Congress with policy evaluation and recommendations, among other elements.

3. Our analysis focuses on two main policies to reduce emissions and boost the green economy: carbon pricing and green investments. For a detailed discussion on a broader set of policies to support the green transition see Spain: 2021 Selected Issues.

- *Carbon pricing*. Most emissions in each major emitting sector are subject to some form of carbon pricing, including via the EU ETS in the power and industry sectors, and via fuel duties in the road transport sector. An explicit domestic carbon tax on fluorinated greenhouse gases has been in place since 2014, covering 3 percent of Spain's total emissions. Nonetheless, effective carbon rates are low relative to estimates of carbon emission damage, and typically lower than in peer economies (in those sectors not covered by a common EU framework). There is also significant variation in levels across sectors. Several international, as well as expert committees set up by the Spanish government itself have recommended an increase in energy-environmental taxation. Spain's 2030 NECP acknowledges the potential role of carbon pricing as a policy tool for climate mitigation, and authorities are in the process of conducting an in-depth review of the environmental taxation.



Sources: Eurostat, and IMF staff calculations.
Note: Environmental taxes include on energy (including explicit CO2 taxes and EU ETS), transport, and pollution/resources. Implicit tax rate on energy is the ratio of energy taxes to final energy consumption.

- *Green investments*. Spain's Recovery, Transformation and Resilience Plan (RTRP) seeks to leverage EU funds to support the economic recovery from the Covid-19 crisis while promoting a structural shift to a more inclusive, digital and greener economy. About 40 percent of the announced investments (€77.2 billion, 5.9 percent of 2022 GDP) for the period 2021–23 are allocated to green projects, with initial investments prioritizing clean energy, sustainable mobility and building efficiency renovations.

B. The Labor Market Impact of Green Investments and Carbon Pricing

Green Investments: Modeling and Multipliers

4. Green investments are modelled as a labor productivity shock since it would increase the level of physical capital and improve sectoral labor productivity. The initial impact on sector-specific labor productivity is computed using information on the green investments announced in

the RTRP and on the stock of fixed assets by industry from Eurostat. The analysis is based on the NACE Rev.2 sectoral disaggregation at the 1-digit level, covering 18 sectors.

Main Green Investments Under the Recovery Plan

Project	Sector	EUR million 2021–23	% of 2018 Capital Stock
Sustainable, safe and connect mobility	Transport	13203	6.39
Building renovation and urban renewal	Construction	6820	1.93
Deployment and integration of renewable energy	Eletricity, gas, power	3165	
Roadmap for renewable hydrogen	Eletricity, gas, power	1555	6.62
Energy infrastructures, smart networks, storage	Eletricity, gas, power	1365	
Conservation and restoration of ecosystems and biodiversity	Agriculture	1642	2.89
Preservation of the coastline and water resources	Water and waste management	2091	3.64

Sources: OECD and IMF staff calculations.

5. We use input-output linkages across sectors to estimate the impact of green investments on output and employment. The direct and indirect multipliers for each sector are computed using the 2018 (latest available) input-output table for Spain. In principle, higher labor productivity for a given sector implies lower relative prices, and lower production costs for downstream sectors. Thus, well-connected upstream sectors, such as mining, transportation, and support services, are expected to see large indirect impact on aggregate output. We used NACE 2-digit sectors for analyzing the propagation of green investments along the input-output network.[4] See Annex I for details on the calculation of the output and employment multipliers.

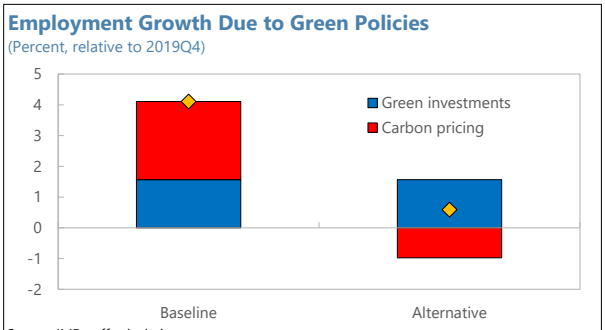
Carbon Pricing

6. We quantify the impact of changes in carbon pricing on employment using estimates from the literature. The estimated impact of carbon pricing on sectoral output is taken directly from Aguilar, González and Hurtado (2022)**.** These authors already incorporate the propagation of carbon pricing through input-output linkages. They compute changes of sectoral GVA in four carbon-pricing scenarios: (i) an increase in the price of CO2 emissions from €25 to €100 per ton; (ii) an expansion of the coverage of the ETS system, to fully cover all emissions from all firms, of all sectors; (iii) a combination of (i) and (ii); and (iv) a combination of (i) and (ii) with the revenue from those measures used to finance a reduction in labor taxes. For our baseline analysis, we map changes in sectoral GVA to changes in employment using the results from scenario (iv). We also produce an alternative scenario based on (iii); detailed results are reported in Annex II. The difference between the two scenarios highlights the importance of using carbon revenues effectively to reduce distortionary taxes and support growth.

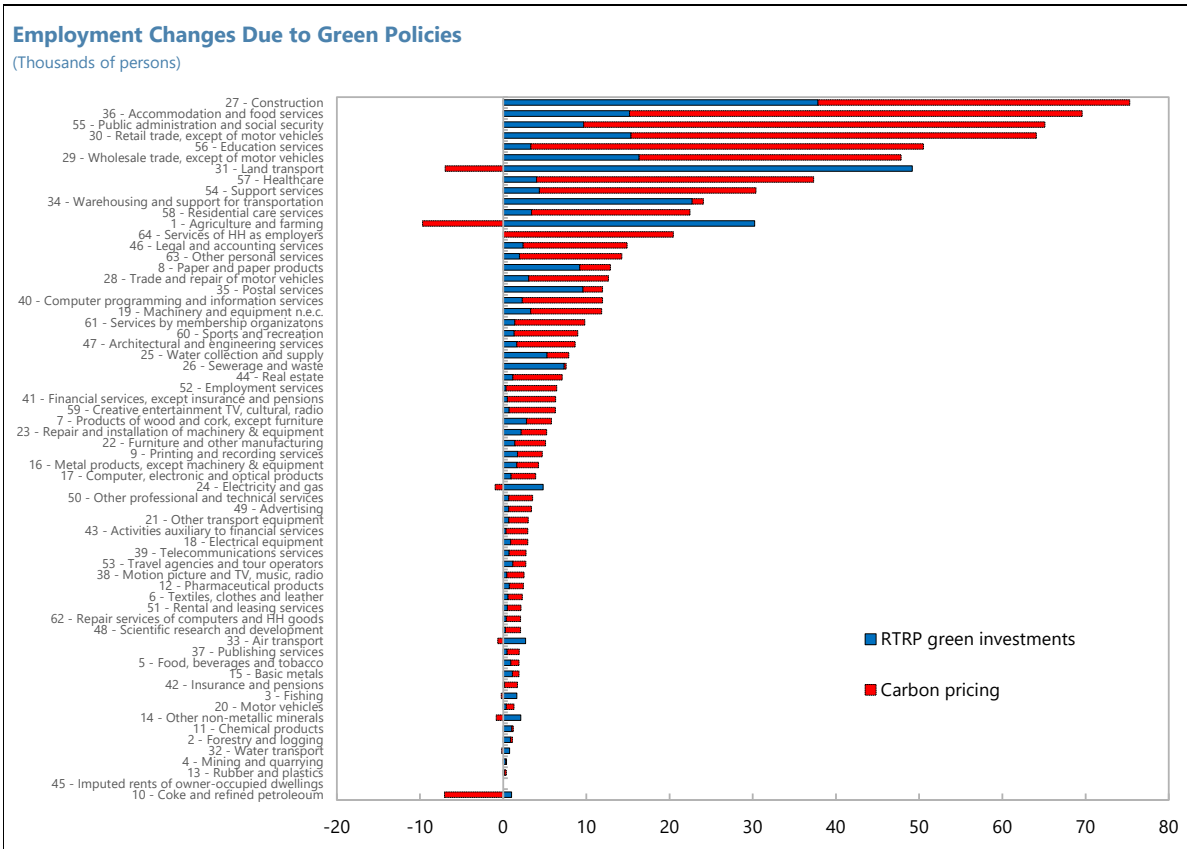
[4] In order to map the investment shock at the 1-digit sector to the 2-digit level input-output table, we assume the same investment shock (in percent change of sectoral capital stock) to each subsector with in the same 1-digit sector.

The Employment Impact of Green Policies

7. While the employment impact of green investments is unequivocally positive, the one of carbon pricing is ambiguous and largely depends on how the collected revenue is used. In our baseline simulation using scenario (iv) from Aguilar, González and Hurtado (2022), carbon pricing has a positive effect on sectoral employment, since the revenue collected from carbon pricing is used to reduce labor taxes. As a result, both green investments and carbon pricing go in the same direction and together the two initiatives would increase overall employment by about 4 percent. Nevertheless, the effect of carbon pricing could be smaller or even negative under different assumptions. In the alternative scenario with the increase in carbon pricing and the expansion in ETS but without the redistribution of the proceeds via lower labor taxes, the employment effect goes down to only 0.6 percent (see Annex II for more details). This is because the employment gains from the green investments are partially offset by the employment losses from higher carbon pricing.



Source: IMF staff calculations.
Note: The difference between the baseline and the alternative scenarios corresponds to the carbon pricing shock. The baseline scenario assumes an increase in the price of CO2 emissions from €25 to €100 per ton and an expansion of the coverage of the ETS system, with the revenue from those measures used to finance a reduction in labor taxes. The alternative scenario is the same as the baseline but without the redistribution of revenues via lower labor taxes.



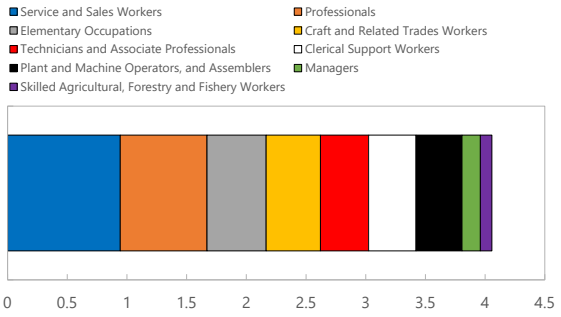
Source: IMF staff calculations.

8. The impact of green investments and carbon pricing is heterogenous across sectors. Coke and Refined Petroleum would experience large declines in employment, which will be offset by significant increases in the other sectors. In the baseline scenario, the positive effects on sectoral employment are mainly due to the carbon pricing shock—more specifically, from the positive effects of labor tax reductions that were made possible by the additional fiscal revenues. In some sectors, the increase in green investment also plays an important role. For example, carbon pricing would negatively impact employment in land transport and agriculture, but this effect would be more than offset by the increase in employment triggered by the green investments in these sectors.

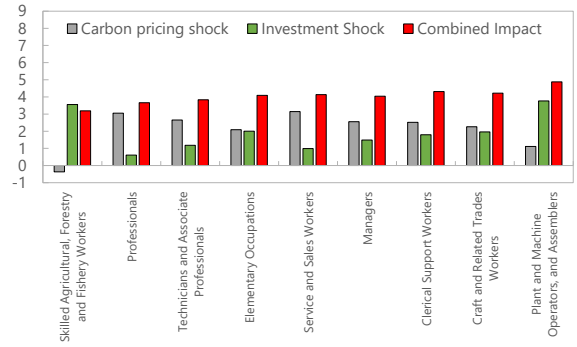
From Changes in Sectoral Employment to Changes in Occupations

9. We map changes in sectoral employment associated with the two greening shocks to changes in occupations. We do so by using the distribution of occupations by sectors in the 2019 Labor Force Survey for Spain. For this exercise we consider a 1-digit and 2-digit disaggregation of occupations according to the ISCO classification.

10. More than half of the overall increase in employment is concentrated in three occupations. Services and sales workers, professionals, and elementary occupations together would contribute more than 2 percentage points to the 4-percent increase in employment due to the greening shocks. The growth of employment in services and sales workers and professionals is largely driven by the carbon pricing shock, while in the case of elementary occupations both shocks contribute more or less in the same proportion. The impact of the investment shock is more prominent among skilled workers in primary occupations and among plant and machine operators and assemblers. However, their shares in total employment tend to be small, resulting in a limited contribution to employment growth.



Sources: Eurostat and IMF staff calculations.



Sources: Eurostat and IMF staff calculations.

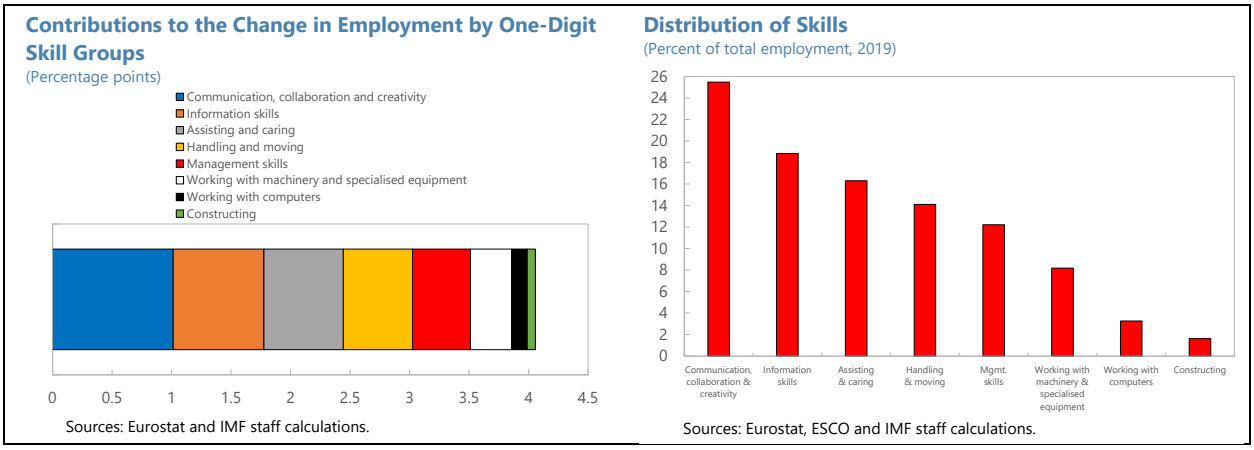
11. Within occupations, there is heterogeneity in the contributions to employment growth by sub-categories. In the case of services and sales workers, the main sub-categories include personal service and sales workers, while the contribution of personal care and protective services workers is more contained. For professionals, the contributions by sub-categories are more evenly distributed, with the largest contribution from teaching professionals. The same observation is valid

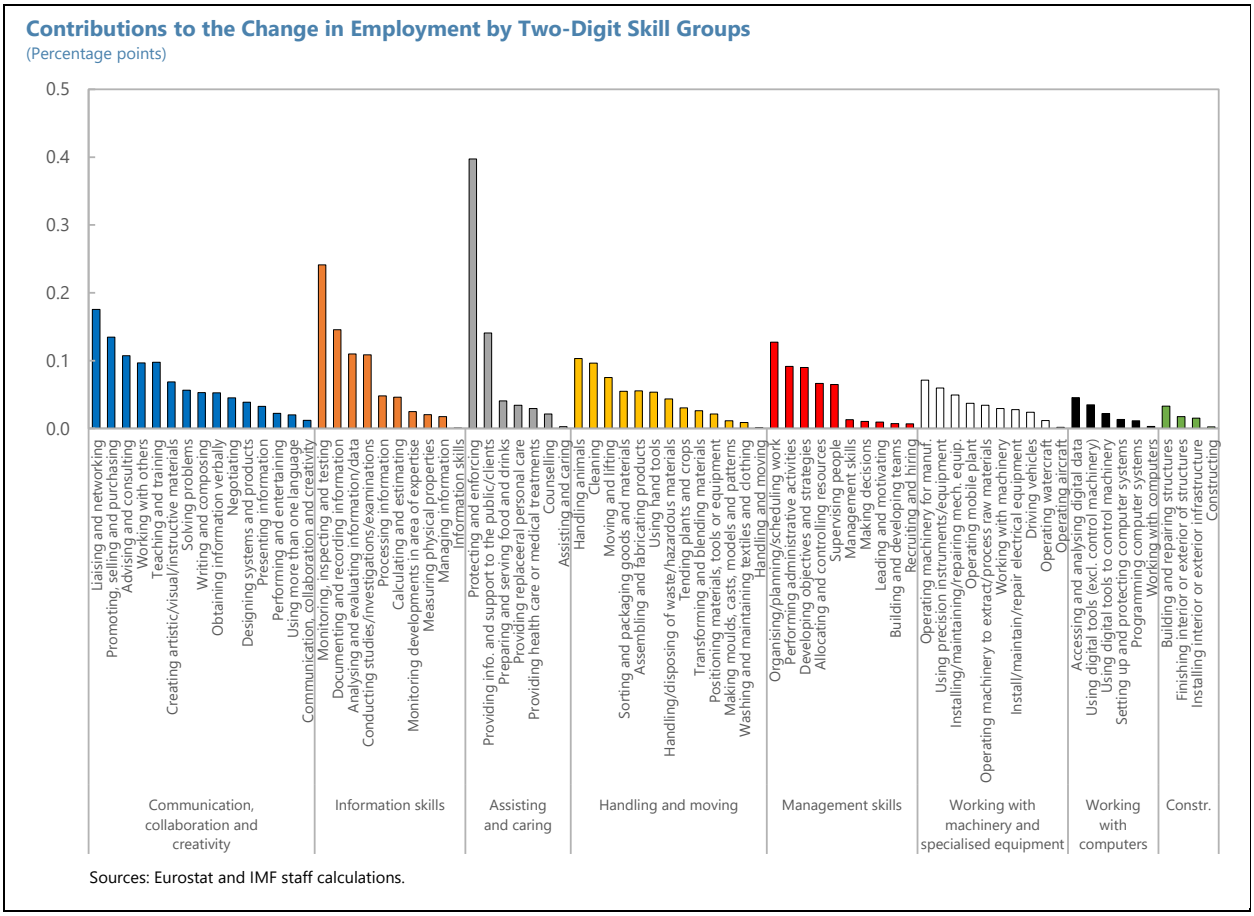
for elementary occupations, with relatively larger contributions by cleaners and helpers and by laborers in mining, construction, manufacturing and transport. Among the categories with relatively smaller contributions, it is worth mentioning some sub-categories with particularly large contributions, such as: building and related trades workers within craft and related trades; drivers and mobile plant operators within plant and machine operators and assemblers; and skilled agricultural workers within skilled workers in primary activities.

From Changes in Occupations to Changes in Skills

12. The changes in occupations are then mapped to changes in skills. We do so by using the distribution of skills for each 1-digit ISCO occupation, as reported in the skills-occupation matrix tables recently published by ESCO. For this exercise we consider a 1-digit and 2-digit disaggregation of skills according to the ESCO classification.

13. As in the case of occupations, more than 60 percent of the growth in employment can be attributed to just three sets of skills, though with great heterogeneity across sub-categories. Communication, collaboration and creativity, information skills, and assisting and caring contribute with 2.4 percentage points to the 4-percent increase in employment. In terms of sub-categories, there are two that have particularly large contributions: monitoring, inspecting and testing within information skills, and protecting and enforcing within assisting and caring. These categories include sub-skills that could be associated with the green economy such as testing vehicles and monitoring environmental conditions (within monitoring, inspecting and testing) and complying with environmental protection laws and standards (within protecting and enforcing).





Sources: Eurostat and IMF staff calculations.

C. Conclusions and Policy Recommendations

14. This paper provides a tractable framework, which takes into account input-output linkages across sectors, to assess the labor market impact of green investments and policies. Such framework is used to quantify changes in sectoral employment, occupations and skills stemming from: (i) the announced green investments in the recovery plan; and (ii) a possible increase in carbon pricing and expansion of ETS, based on the scenarios developed by Aguilar, González and Hurtado (2022).

15. Productive green investments can help support employment growth and lead to labor reallocation during the green transition. The green investments contemplated in the recovery plan correctly target sectors that need upscaling to adapt to the green transition. Nevertheless, the results discussed in this chapter may change if information on green investments or the distribution of occupations across sectors is available at a more granular level. Ensuring effective implementation of these investments and continued proper identification of future investment projects are critical for the positive effects from green investments to materialize.

16. Even in an optimistic scenario, some sectors—the most polluting ones—would suffer employment losses and their workers would likely need to transition to expanding sectors. Coke and Refined Petroleum would be the main sector that could suffer employment losses from the

combined effect of the greening shocks because the negative impact from carbon pricing is not offset by the positive impact from the investment projects. For this shrinking sector, it is crucial to strengthen ALMPs, with focus on training, to facilitate reallocation. Spain has introduced reforms to promote reskilling and requalification of workers, including in shrinking sectors. The 2021 labor reform incorporated training incentives to the short-time work schemes (ERTEs and the new RED mechanism). In particular, the Sectoral-RED Mechanism, which targets economic sectors that are experiencing structural changes, requires companies to develop a requalification plan for affected workers. Spain's RTRP also contemplates reforms to strengthen ALMPs with the aim of improving labor matching and addressing skill mismatches. The proposed legal framework foresees the creation of personalized itineraries to support training and re-skilling of low-employability groups, focusing on the development of those skills that companies demand the most.

17. The design of carbon pricing policies is critical for the employment outcomes during the green transition. Our baseline results rely crucially on the assumption that carbon pricing proceeds would be redistributed in the form of a uniform reduction of labor taxes. Given that the reduction of labor taxes equalizes across sectors and occupation, the redistribution would lead to positive employment effects across-the-board without creating any incentives for labor reallocation. A different use of the proceeds from carbon pricing would in principle result in a different outcome.

18. There are other greening policies the effect of which could in principle be analyzed using the framework of this paper. Sectoral climate policies, including regulations and standards, will be essential to address sector-specific obstacles to reducing emissions, particularly in the transport, building and power sectors. For a detailed discussion on these complementary policies to support the green transition see Spain: Selected Issues (2022).

References

Acemoglu, D., Akcigit, U., and Kerr, W. (2015). *Networks and the Macroeconomy: An Empirical Exploration*. NBER Macroeconomic Annual.

Aguilar, P., González, B., and Hurtado, S. (2022). *Carbon Tax Sectoral (CATS) Model: A Sectoral Model for Energy Transition Stress Test Scenarios*. Documentos Ocasionales 2218. Madrid: Bank of Spain.

Carvalho, V. M., and Tahbaz-Salehi, A. (2019). *Production Networks: A Primer*. Annual Review of Economics.

IMF. (2022). *France: Selected Issues*. Washington, DC: International Monetary Fund.

IMF. (2022). *Spain: Selected Issues*. Washington, DC: International Monetary Fund.

Izquierdo, M., Moral-Benito, E., and Prades, E. (2019). *Propagation of Sector-specific Shocks within Spain and Other Countries*. Madrid: Bank of Spain.

Annex I. Estimation of Output and Employment Multipliers Using the Input-Output Approach

The Input-Output Structure of the Economy

We model the Spanish economy as consisting of n competitive sectors, denoted by $\{1,2,\dots,n\}$. Each sector produces a distinct product using intermediate goods produced by other sectors and labor as inputs. The production function is Cobb-Douglas, and the output of industry i can be written as:

$$y_i = z_i l_i^{\alpha_i} \prod_{j=1}^{n} x_{ij}^{a_{ij}}, \tag{1}$$

where l_i is the amount of labor hired by firms in sector i, x_{ij} is the quantity of good j used for production of good i as intermediate inputs, and z_i is the labor productivity in sector i. α_i and a_{ij} are the labor and intermediate input shares, characterized by the following equations (assuming p_i is the price of good i and w is the equilibrium wage):

$$\alpha_i = \frac{w l_i}{p_i y_i}, a_{ij} = \frac{p_j x_{ij}}{p_i y_i} \tag{2}$$

$$\alpha_i + \sum_{j=1}^{n} a_{ij} = 1$$

The Propagation of Supply/Productivity Shocks

Production function (1) can be re-written as:

$$\log y_i = \log z_i + \alpha_i \log l_i + \sum_{j=1}^{n} a_{ij} \log x_{ij}, \tag{3}$$

which describes the direct impact of a supply shock to labor productivity z. Suppose that industry j is hit by a negative shock to productivity z_j that reduces its production and thus increases the price of good j, for example a higher tax imposed to the final product, the increase in prices would affect all industries that use good j as an intermediate input for production, thus creating a direct impact on j's consumer industries. The direct multiplier is then just the coefficient of the input output matrix, a_{ij} (assuming a partial equilibrium, so prices in other sectors as well as wages do not respond. The change in sectoral employment is:

$$\Delta \log l_i = \frac{\Delta \log y_i}{\alpha_i} = \frac{a_{ij}}{\alpha_i} \Delta \log z_j \tag{4}$$

The input-output connections across sectors can be summarized with a matrix:

$$A = [a_{ij}],$$

which we refer to as the economy's input-output matrix. Plugging equations (2) into the log-linearized production function (3), we get:

$$\log\left(\frac{p_i}{w}\right) = \sum_{j=1}^{n} a_{ij} \log\left(\frac{p_j}{w}\right) - \log z_i$$
$$\Rightarrow \hat{p} = -(\mathrm{I} - \mathrm{A})^{-1} \log z\,,$$

where the relative price vector is defined as $\hat{p} = (\log\left(\frac{p_1}{w}\right), \log\left(\frac{p_2}{w}\right), \ldots, \log(\frac{p_n}{w}))'$. Combining households' Cobb-Douglas utility function and define $H \equiv (I - A)^{-1}$, we can further write the log output of each industry as.[1]

$$\ln y = H \ln z + constant$$
$$\Rightarrow \ln y_i = \sum_{j=1}^{n} h_{ij} \ln z_j + constant \qquad (5)$$

Equation (5) captures the direct and indirect spillover of supply shocks (or productivity shocks): the initial impact characterized in equation (4) will also result in further propagation to the downstream sectors through the input-output linkages. The prices of goods produced by industries affected in the first round of propagation will increase, creating an indirect negative effect on their own customer industries, and so on.

The reason that productivity shocks do not propagate upstream to the suppliers is a result of modeling assumptions: (a) Cobb-Douglas preferences and technologies, (b) a single factor of production (in this case labor), and (c) constant returns to scale. (b) and (c) together ensure that productivity shocks only affect upstream sectors through wage changes, prices relative to the wage are not affected.[2]

Supply Shock Multipliers

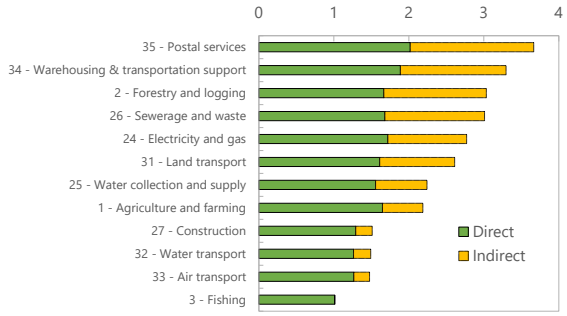
The direct and indirect multipliers of the sectoral supply shock—i.e., the green investment shock—are summarized in the charts below.

[1] For the proof equation (5), see Acemoglu et al. (2015) and Carvalho and Tahbaz-Salehi (2019).

[2] For more discussions on the features of the model and possible extensions (including imperfect competition, and non-constant return to scale, etc.), see Carvalho and Tahbaz-Salehi (2019).

Green Investments: Output Multiplier by Sector

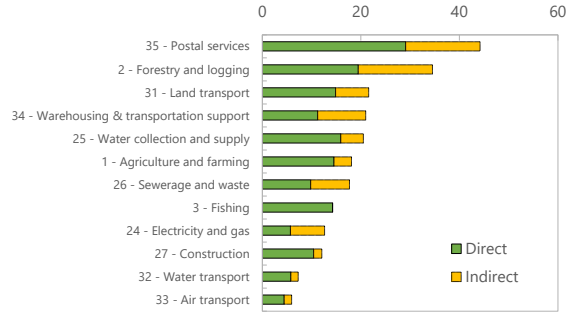
(Increase in gross output--measured in Euros--per Euro of additional output in a given industry)



Sources: IMF staff calculations.
Note: The chart shows the 12 two-digit sectors with the largest multipliers.

Green Investments: Employment Multiplier by Sector

(Increase in employment--measured in persons--per 1 million additional output in each industry)



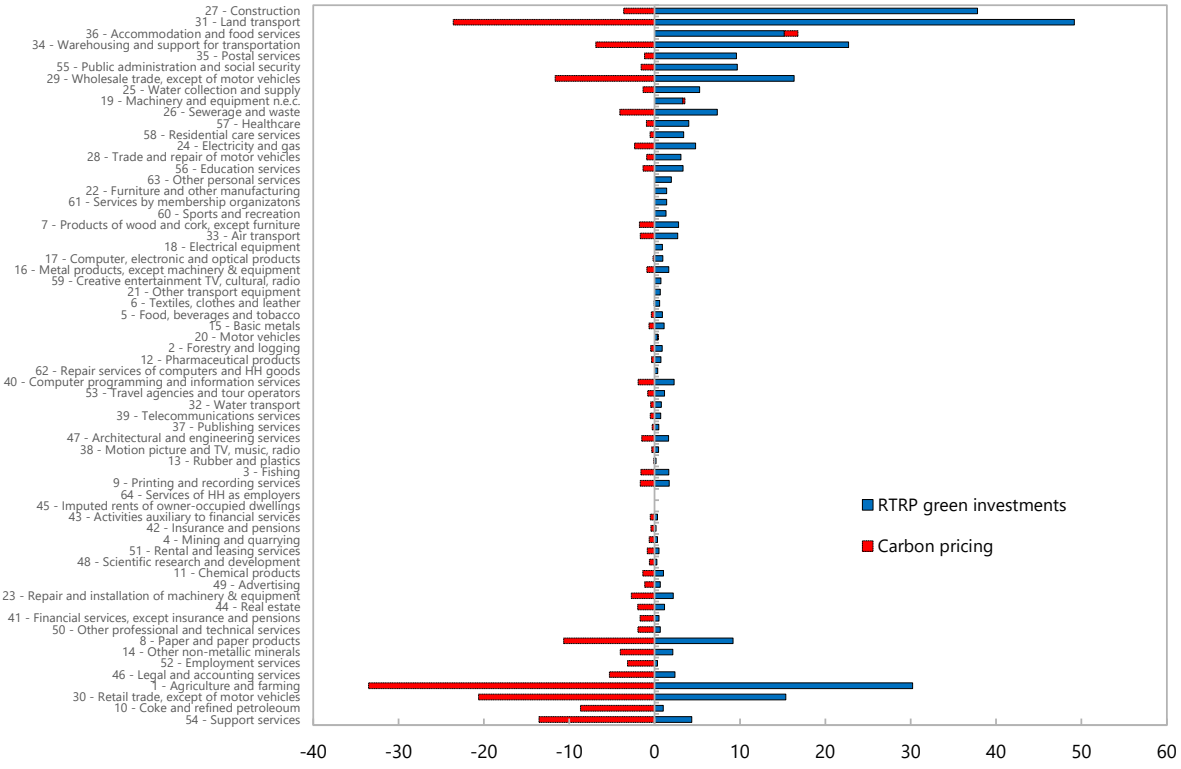
Sources: IMF staff calculations.
Note: The chart shows the 12 two-digit sectors with the largest multipliers.

Annex II. Results for the Alternative Carbon Pricing Shock Scenario, Not Taking into Account the Redistribution of Revenue Proceeds

Annex II. Figure 1. Employment Changes Due to Green Policies

Employment Changes Due to Green Policies

(Thousands of persons)

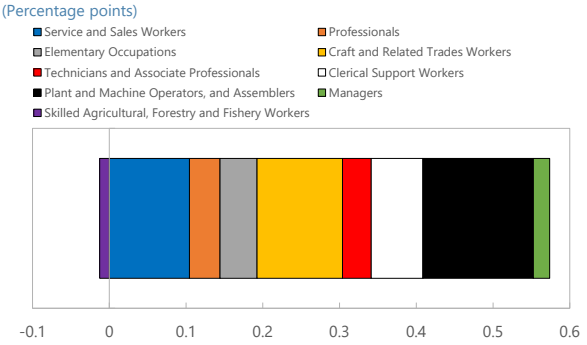


Source: IMF staff calculations.

Annex II. Figure 1. Employment Impact Across Occupations and Skills Groups

Contributions to the Change in Employment by One-Digit Occupation Groups

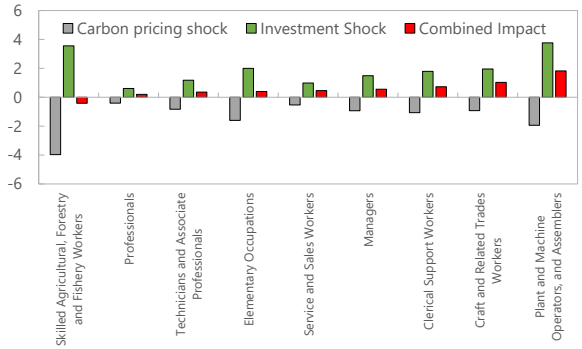
(Percentage points)



Sources: Eurostat and IMF staff calculations.

Change in Employment by One-Digit Occupation Groups

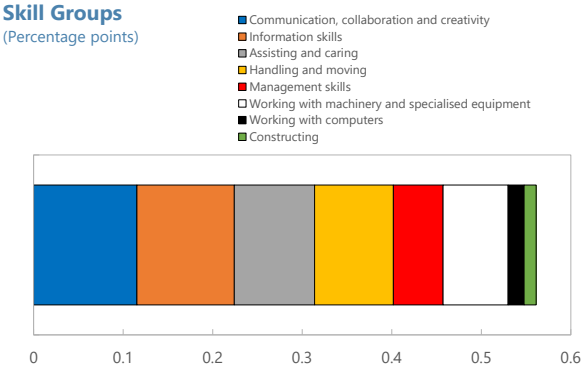
(Percent, with respect to 2019:Q4)



Sources: Eurostat and IMF staff calculations.

Contributions to the Change in Employment by One-Digit Skill Groups

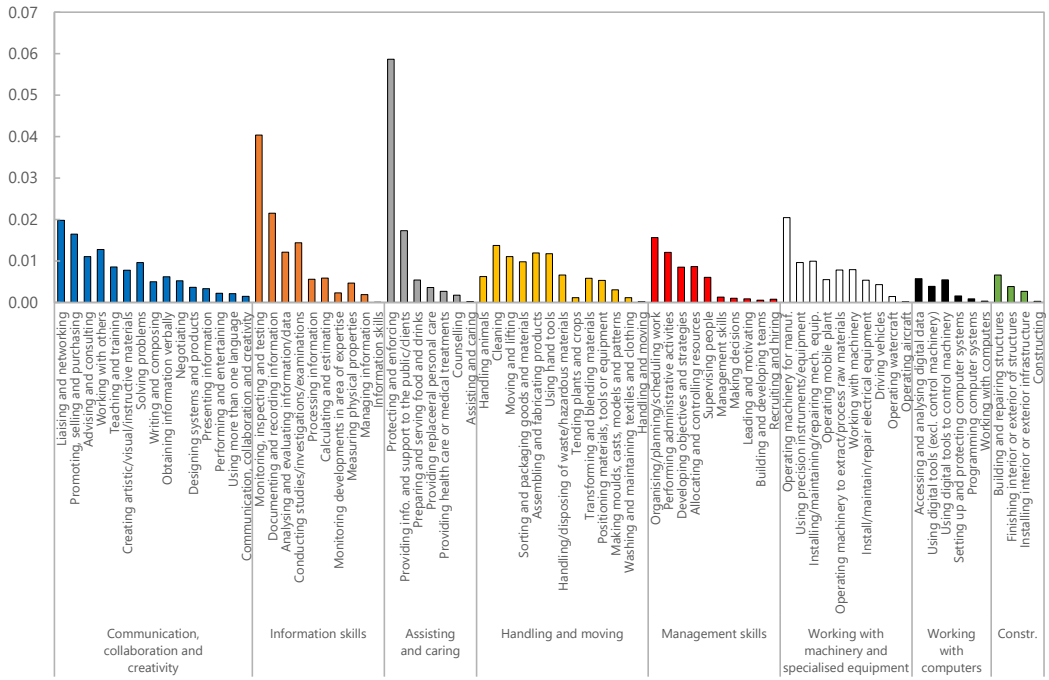
(Percentage points)



Sources: Eurostat and IMF staff calculations.

Contributions to the Change in Employment by Two-Digit Skill Groups

(Percentage points)



Sources: Eurostat and IMF staff calculations.