2

# BANCO DE PORTUGAL
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2

# Banco de Portugal

# Economic Studies

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# Content

# Editor's note[1]

## Pedro Duarte Neves

April 2022

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1. This issue of Banco de Portugal Economic Studies publishes three studies. The first analyses the financial literacy of 15-year-old students in Portugal. The other two studies disclose composite competitiveness indicators for the Portuguese economy: an aggregate competitiveness indicator and a firm-level competitiveness indicator. All three studies compare the results for Portugal with those of other advanced economies.

2. Financial literacy is the ability to understand and use key financial concepts efficiently.[2] Financial customers that are better informed and have greater financial literacy can make decisions that better match their risk profile, be it while managing the family budget, making saving options, or choosing between alternative financial products. Greater financial literacy will tend to make non-compliance with obligations, excessive indebtedness and financial exclusion less likely; overall, greater financial literacy will strengthen the resilience of the financial system against adverse shocks, contributing to macroeconomic and financial stability.

Particularly from the beginning of the past decade, the application of financial literacy surveys[3] was conducted regularly in Portugal and in most advanced economies, and national plans for financial education[4] were developed. In January this year, the European Commission and the OECD's International Network on Financial Education (INFE) published a benchmark for financial literacy skills for adults, identifying the financial knowledge, attitudes and behaviours needed for informed and more

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1. The analyses, opinions and conclusions expressed in this editorial are entirely those of the editor and do not necessarily coincide with those of Banco de Portugal or the Eurosystem.

2. The OECD defines financial literacy as follows: "A combination of awareness, knowledge, skill, attitude and behaviour necessary to make sound financial decisions and ultimately achieve individual financial wellbeing".

3. The first survey on the financial literacy of the Portuguese population was carried out by the Banco de Portugal in 2010 and targeted aspects such as financial inclusion, expenditure planning and savings, bank account management, financial product choice and financial awareness. The second and third surveys on the financial literacy of the Portuguese population (2015 and 2020, respectively) were developed under the aegis of the National Council of Financial Supervisors.

4. In 2011 the National Council of Financial Supervisors presented the Portuguese National Plan for Financial Education 2011-15, which set out the general principles for promoting financial literacy and brought together the efforts of several Portuguese public sector entities. The current Portuguese National Plan for Financial Education focuses on the period 2021-25.

appropriate decision-making.[5] In Europe, also in January, the Joint Committee of European Supervisory Authorities released a repository of financial education initiatives developed by the NCAs, with a special focus on digitalisation.[6]

Financial education and literacy initiatives are very important for strengthening social capital, with the resulting benefits for the stability and resilience of financial systems. The relevance of financial literacy in Economic Sciences has been recently enhanced, having been assigned a separate code in the Journal of Economic Literature classification: "G53 – Financial Literacy".[7] Economic Science has improved knowledge of financial literacy in several ways, especially through (descriptive or causal) econometrics and behavioural economics. The first study in this publication contributes to the knowledge of financial literacy in Portugal.

3. The study by Reis and Wemans assesses the financial literacy of 15-year-old students using the OECD's PISA 2018 (Programme for International Student Assessment), the first time Portugal participated in the financial literacy module. The content of this exercise is highly informative, given the representativeness of the sample – more than 4,000 students assessed in Portugal – and the possibility of international comparison. The results achieved are generally satisfactory for Portugal, which is in the upper half of the European countries considered in terms of financial literacy: above countries such as Italy and Spain, but below countries such as Estonia and Finland. Financial literacy in Portugal is, for example, very close to that of the United States of America, although it tends to be less dispersed in distribution.

The study presents important results. In Portugal, the main financial literacy shortcomings tend to be associated with school failure and parents' low level of schooling. These gaps are also more frequent in first-generation immigrants and, albeit slightly less so, in girls. Financial literacy is lower in the Azores, in Madeira and in Alentejo, and, to a lesser extent, in the Algarve.

Access to financial means of payment (online payments, bank account and payment cards) for 15-year-olds in Portugal is close to – or slightly below – access in Italy and in the United States. The authors conclude that greater use of these means of payment is not always associated with higher levels of financial literacy. For example, for all three countries there is a negative relationship with financial literacy in mobile payments.

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5.   See *Financial competence framework for adults in the European Union*, European Union/OECD-INFE, 2022.

6.   *Joint ESAs thematic repository of national financial education initiatives on digitalisation – with a specific focus on cybersecurity, scams and fraud*, published on 31 January 2022.

7.   The G53 code was created in 2019. The G refers to Financial Economics, the G5 to Household Finance. The definition is as follows: "Covers studies about issues related to household or personal finance, including saving, portfolio consumption of financial assets, personal bankruptcy, financial literacy, demand for private and social insurance, and bequests. Studies about issues related to payment choice, e.g., debit vs credit vs bitcoin vs Venmo, should be classified here as well".

Naturally, such results are very useful for the design and development of financial literacy initiatives by public authorities.

4. This publication presents two studies developing competitiveness indicators for the Portuguese economy. The competitiveness of an economy is a complex concept – and generally not quantifiable – used to indicate whether or not an economy has favourable conditions conducive to long-term sustainable growth. This concept seeks to summarise how various key factors in the functioning of an economy can contribute to its long-term growth. Without being exhaustive, it is common to consider the following growth factors: macroeconomic and financial stability, institutions, human capital, product and labour markets, infrastructure, innovation and adoption of new technologies, market size and corporate dynamics.

Some international organisations regularly disseminate country-level competitiveness indicators. These summary indicators – through very diverse methodologies, which essentially correspond to a combination of quantitative economic indicators and qualitative perception indicators – set out a ranking of national economies, identifying the most and the least competitive. To summarise, these rankings tend to coincide with the ranking of the most competitive economies (Singapore, Hong Kong, the United States, New Zealand, Switzerland, Sweden and Denmark) and the euro area (the Netherlands and Finland). Portugal tends to be in a position close to, albeit slightly below, the median position in the euro area.[8] Despite their predominantly subjective nature, these rankings make it possible to identify areas for possible improvement in terms of creating more favourable conditions for long-term economic growth.

5. The second study in this publication, by Amador, Fernandes and Nogueira, presents a composite competitiveness indicator for European countries, covering the period 1995-2020. The study uses databases from several institutions: Eurostat, World Inequality Database, World Bank and AMECO. The indicator covers four dimensions of competitiveness: economic stability and income distribution, education and innovation, investment and infrastructure, and institutions and markets. The composite indicator – which combines in one value a set of 25 indicators grouped under these four dimensions – offers a relative positioning of the competitiveness of each country.

The study presents three main results: the competitiveness of the Portuguese economy is very close to that of other southern European countries (such as Spain and Italy), although it is below that of northern or central European countries (Sweden and Austria); Portugal strengthened its competitive position in the period 2014-20; finally, no negative impact of the COVID-19 pandemic on the competitive position of Portugal

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8. The most widely used international competitiveness indicators are: IMD World Competitiveness Center Ranking, IMD Digital Ranking, Global Competitiveness Index. Taking the euro area countries as a benchmark, Portugal ranked 12th on all these indicators in the latest available edition (referring to 2021, 2021 and 2019 respectively).

is observed, although, as already mentioned, the sample period ends in 2020.

6. The final study in this publication, by Lourenço, Magalhães, Martins, Pereira and Reis, presents a composite firm-level competitiveness indicator. This indicator is calculated for five euro area countries – Portugal, Spain, France, Italy and Belgium – for 2008-18. The study uses information from the iBACH database in a relatively pioneering manner. This database was developed under the aegis of the European Committee of Central Balance Sheet Data Offices and includes harmonised economic and financial information for non-financial corporations in Europe. The composite indicator summarises six dimensions of competitiveness: profitability, production costs, productivity, access to productive resources, economic and financial situation, and quality orientation. The composite competitiveness indicator provides information on the positioning at firm level, by sector and by country.

The study concludes that Portuguese firms are less competitive than firms in the other countries considered and that this is true for most economic sectors and for different enterprise sizes. However, in the final period of the sample (2015-18), the competitiveness indicator for Portugal was observed to edge closer to that of the remaining countries.

# Non-technical summary

April 2022

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### Financial literacy of 15 years-old in Portugal: Evidence from PISA 2018

*Hugo Reis, Lara Wemans*

Financial literacy is an increasingly vital skill in modern societies. Low levels of literacy have been associated to poor financial decisions, with potential long-lasting effects on households living conditions. Thus, monitoring it is crucial from a public policy perspective.

Portugal participated for the first time in the OECD/PISA 2018 financial literacy assessment of 15 years-old students. In PISA, the concept of financial literacy covers diverse day-to-day situations adapted to this age group. The Portuguese results are close to Spain and the US, lower than the top performers Estonia and Finland, but higher than Italy, which has been consistently found to have very low levels of financial literacy for an advanced economy.

PISA classifies students into five increasingly challenging levels, taking into account the tasks they are able to perform. We consider that students have an insufficient level of financial literacy when they cannot, for instance, correctly apply commonly used financial concepts, nor to use financial information to make decisions that are immediately relevant to them. In Portugal, the probability of students who repeated a grade to have an insufficient level of financial literacy is estimated at 42%, which compares to only 3% for those who have not. This probability is also higher for first generation immigrants (36%), for those whose parents have not completed the 12th grade (21%) and for teenagers from disadvantaged socio-economic backgrounds (proxied by the number of books at home) (18%) (Figure 1). Conditional on other characteristics of the students, their families and schools, teenagers with the above-mentioned characteristics have on average much lower scores than their peers, and the same happens for girls.

Access to financial products is already non-negligible for 15 years-old in Portugal, as 45% hold a bank account and 24% a payment or debit card. Alternative sources of payment such as online or by phone are used by, respectively, 58% and 28% of teenagers in this age group. Half of the students state that questions on financial literacy topics in school were addressed in maths classes, a quarter in another class and a fifth report having discussed them with an outside visitor or in an extracurricular activity. However, parents are the most common source of information about money matters (95%), and tv or radio and the internet (both around 80%) are also more common than teachers (43%).

At the regional level, the islands of *Açores* and *Madeira* taken together, and *Alentejo* are the regions where 15 years-old present the lowest average scores on financial literacy.

(A) Parents' education

(B) Books at home

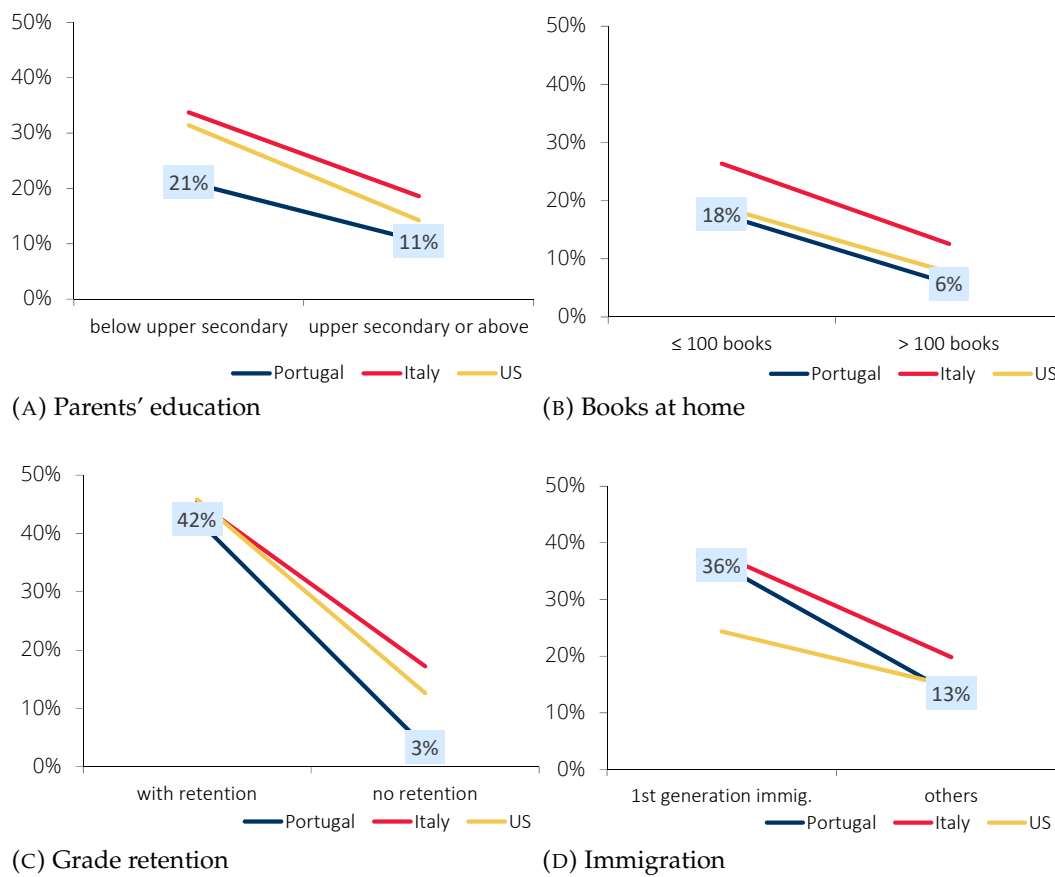(C) Grade retention

(D) Immigration

FIGURE 1: Percentage of students which have an insufficient level of financial literacy

Source: OECD PISA 2018.

Note: Labels highlight the results for Portugal.

For these regions, the share of students with insufficient results overcomes 20% and is in line with the figure for Italy.

# Financial literacy of 15 years-old in Portugal
# Evidence from PISA 2018

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April 2022

**Abstract**
This paper analyses the results for Portugal in the PISA 2018 financial literacy assessment, comparing with other countries and, in particular, with two countries often studied in this literature: Italy and the US. The results for the average Portuguese with 15 years-old are similar to the US and better than Italy. Still, 14% of Portuguese teenagers show severe difficulties in financial literacy, with special prevalence in those with a history of school retention, immigrants, coming from disadvantaged socio-economic backgrounds or whose parents have low educational attainment. The access to financial products among teenagers is lower in Portugal than in the US or Italy and a regional analysis shows lower financial literacy scores in *Alentejo* and in the islands of *Açores* and *Madeira*. (JEL: G53, I22)

## 1. Introduction

A low level of financial literacy is detrimental for social inclusion in modern societies. The widespread access to complex financial products and to a broad range of payment methods related to the expansion of Fintech increases risk exposure. Moreover, young adults take important decisions requiring the understanding of financial information. These include, for instance, taking a student or car loan, signing a mortgage contract or starting a savings plan. In addition, phone and online payments are increasingly popular among teenagers. According to OECD (2020a), 58% of the 15 years-old in Portugal make online payments and 28% use their phones to pay. But how are Portuguese teenagers equipped to take these decisions? How do we compare to other countries and which characteristics are related to the students' level of financial literacy?

The attention devoted to this topic has risen in the aftermath of the financial crisis, with clear understanding of the impacts on the whole economy arising from ill-informed individual financial decisions. Lusardi and Mitchell (2014) develop a theoretical model explaining that, if the welfare state is more efficient in smoothing consumption for individuals with low educational attainment they face fewer incentives to invest in financial education, acquiring below optimal financial literacy from a global welfare

perspective. In addition, Lusardi *et al.* (2017) construct a life-cycle model explaining the financial literacy hump-shaped pattern with age and showing that differences in financial literacy could play a major role in generating wealth inequality.

Acknowledging the importance of financial literacy, the Portuguese financial sector supervisors (Banco de Portugal, the Portuguese Securities Market Commission and the Portuguese Insurance and Pension Funds Supervisory Authority) launched for the first time in 2011 a five-year national strategy for financial education. More recently, in 2018, a compulsory subject covering a wide set of topics, including financial education, was introduced in school curriculum for primary and lower secondary education.

For teenagers, the educational system would be the main public policy instrument to promote financial literacy, also taking into account a strong connection between financial literacy and numeracy skills. As to the impact of financial education in schools, a literature review in Kaiser and Menkhoff (2020) focused in quasi-experimental studies indicates positive and significant effects on financial knowledge but more nuanced effects on behaviour.

There is a wide literature devoted to the causes of educational achievement, which typically addresses three types of influences: individual characteristics, family background and school features, through the lens of an education production function (Hanushek *et al.* 2016). Individual and family related variables tend to appear as more relevant than school characteristics in explaining students' test scores. Evidence for Portugal in Pereira and Reis (2012), also supports this finding. The explanatory power of family is typically interpreted as a measure of equal opportunities for children from different social backgrounds.

Several studies have shown that financial literacy in advanced economies is low taking into account the wide range and complexity of financial decisions that individuals have to take nowadays, as documented for instance in Lusardi (2019) and Klapper and Lusardi (2020). The most influential studies are based on the "big three" questions which design is explained in Lusardi and Mitchell (2014) and encompass interest, risk diversification and inflation. Moreover, low financial literacy levels, after controlling for wealth, income and other individual and family characteristics, have still been associated with poor financial decisions and costly contracts, which can have long-lasting effects on households living conditions (Lusardi and Mitchell 2015).

There are many surveys based mainly on the "big three" questions that allow for an international comparison of financial literacy and some include results for Portugal. It is the case of the surveys conducted in 2014 by Standard and Poor's and in 2016 by Allianz which place Portugal as a low performer among European partners. The country has also participated in the two editions of the more encompassing OECD/INFE International Survey for Adult Financial Literacy, the most recent in 2020, on which the overall financial literacy score includes not only questions on financial knowledge, but also on behaviour and attitudes. Although the Portuguese score on financial knowledge

in this survey in 2020 was below OECD average[1], the opposite happened for the overall financial literacy score. A detailed analysis of the results for Portugal is available in Conselho Nacional de Supervisores Financeiros (2021)[2].

In the field of young financial literacy, Lusardi *et al.* (2010) focus on young adults (23-28 years-old) in the US using the "big three" questions and conclude that financial literacy is related to socio-demographic characteristics, in particular gender, educational achievement, parents' education and household financial sophistication. More recent research in Alessie *et al.* (2019) tries to disentangle the gender gap in this field and find that around 1/3 of it relates to lower confidence of women. Using a similar measure of financial literacy but taking advantage of longitudinal data, Tang (2017) finds evidence of an intergenerational transmission of financial literacy, through financial experience and knowledge. Cameron *et al.* (2014) use results from a broader questionnaire specially designed to be applied to high school students in five schools in New Zealand. They find that having a bank account, English as a native language and better self-reported mathematics skills are associated with higher financial literacy, while living in a neighbour with higher social deprivation with a lower one.

A very comprehensive measure of financial literacy of 15 years-old, along with detailed socio-economic characteristics of the students and their families became available with the inclusion of financial literacy as an optional component in the 2012 OECD's Programme for International Student Assessment (PISA). Using this data for Estonia, Riitsalu and Põder (2016) find evidence of negative effects on the results for girls, for those from a disadvantaged socio-economic background and for Russian-speaking students, even after controlling for their proficiency in mathematics and reading. For Italy, Bottazzi and Lusardi (2021) focus on gender differences, and find significantly lower levels of financial literacy in girls with an important role of mothers and cultural environment in shaping those differences.

The novelty of this paper is the fact that it is the first of our knowledge to address financial literacy of Portuguese teenagers using the rich set of information provided by PISA. Although we recognise that PISA data has important limitations, we believe it is still relevant namely to 1) grasp how Portuguese students compare to their peers in other countries and 2) signal some features that are related to severe lack of basic financial literacy in teenagers and that should be particularly addressed by public policy. The findings presented in this paper should be complemented with other analysis and a note of caution is warranted, as we do not claim a causality link for the regressions performed.

The remainder of the paper is organized as follows. Section two focuses on the international comparison of financial literacy and section three on the characteristics of students and their families that are associated to the results obtained. Section 4 addresses additional information available on PISA, namely sources of financial information,

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1. There were 11 OECD countries with comparable data in this survey, namely, Austria, Colombia, Czech Republic, Estonia, France, Germany, Hungary, Korea, Poland, Portugal and Slovenia.

2. This report stresses that, for the financial knowledge related questions, the proportion of non-response in Portugal increased significantly in 2020 vis-à-vis 2015.

exposure to financial literacy at school and financial experience of 15 years-old. Section 5 presents a regional analysis and section 6 is devoted to the main conclusions.

## 2. How does Portugal compare?

Portugal participated for the first time in the 2018 edition of the PISA financial literacy assessment, based on a representative sample of 15 years-old in school, which includes more than four thousand observations regarding Portuguese students. The definition of financial literacy endorsed by OECD is "a combination of awareness, knowledge, skill, attitude and behaviour necessary to make sound financial decisions and ultimately achieve individual financial well-being", in OECD (2018) pp 4. Figure 1 illustrates the way this definition is incorporated in PISA.
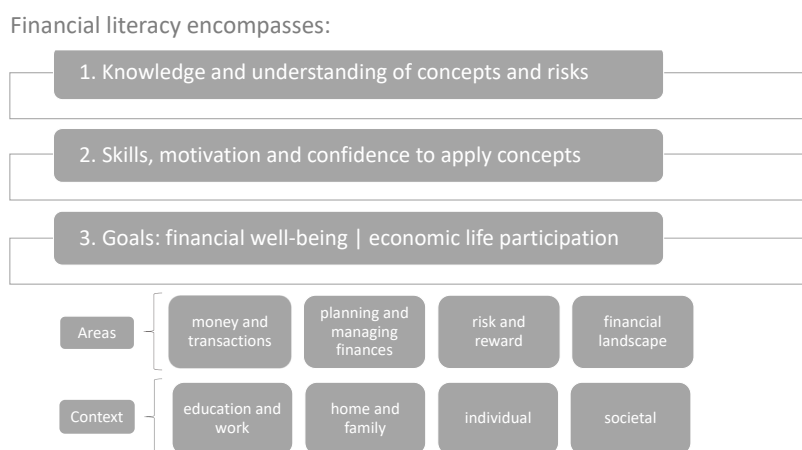
Financial literacy encompasses:

1. Knowledge and understanding of concepts and risks

2. Skills, motivation and confidence to apply concepts

3. Goals: financial well-being | economic life participation

| Areas | money and transactions | planning and managing finances | risk and reward | financial landscape |
| Context | education and work | home and family | individual | societal |

FIGURE 1: Definition of financial literacy used in PISA

PISA financial literacy module consists of a one-hour test including 43 questions[3] designed to adequately cover all features in Figure 1. The financial literacy score is constructed so that the mean among OECD countries is 500 points and the standard deviation is 100. From the 13 OECD countries participating in this assessment in 2018 with comparable data, the Portuguese students appear on a median position, with results close to Spain and the US, lower than the top performers Estonia and Finland, but higher than Italy (Figure 2). In terms of dispersion, differences between countries are not striking, although it is possible to observe a lower dispersion in Portugal than in the US, for instance.

The PISA report also classifies students into five increasingly challenging proficiency levels, reflecting the tasks they are able to perform (see Figure A.1 in the appendix for a detailed description). Low performers can be identified as those that do not reach proficiency level two, which have a financial literacy score below 400 (one standard deviation below the mean for the OECD total). For instance, these students cannot

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3. For examples of the questions used in the field-trial, see Annex C on OECD (2020a), permanent link: `https://doi.org/10.1787/48ebd1ba-en`.
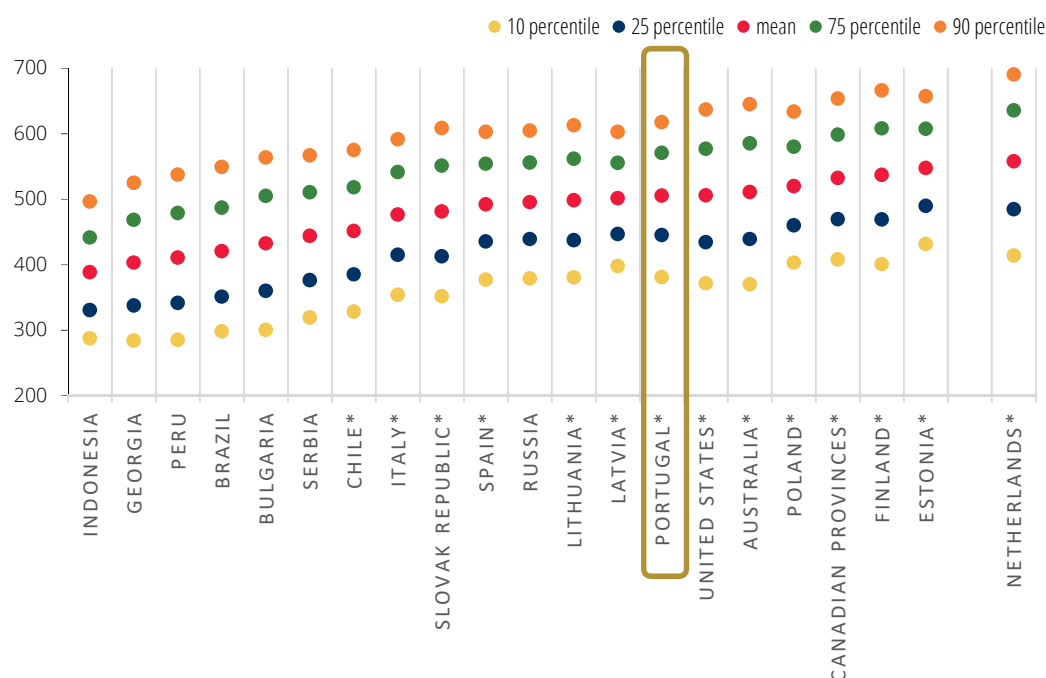
FIGURE 2: Performance in financial literacy - means and percentiles

Source: OECD PISA 2018.
Notes: Results for the Netherlands may not be comparable due to underrepresentation of weaker students.
(*) OECD countries. Countries ranked by the mean.

correctly apply commonly used financial concepts, nor to use financial information to make decisions that are immediately relevant to them. The questions released by OECD from the field trial and associated to proficiency level two include: 1) explaining how making a donation by giving a card number by phone to an unknown charity may entail a financial risk; 2) understand what are the consequences of not honouring a mobile phone contract signed by their parents. Some 14% of the Portuguese students covered by this report are low performers. This figure reaches 21% in the case of Italy and Slovakia (Figure 3A).

*Portugal vis-à-vis Italy and the US*

Italy has been consistently found to have very low levels of financial literacy for an advanced economy along with a relevant gender gap (Bottazzi and Lusardi 2021), while the US has been the focus of some of the seminal papers in this subject. Comparing to Portugal, Italy has a similar distribution, but lower levels of financial literacy, while the US has a lower concentration of students in medium proficiency levels and a higher proportion of top performers (Figure 3B). In the remainder of the paper, these two countries would be the benchmarks for framing the results found for Portugal.

(A) Percentage of top and low performers

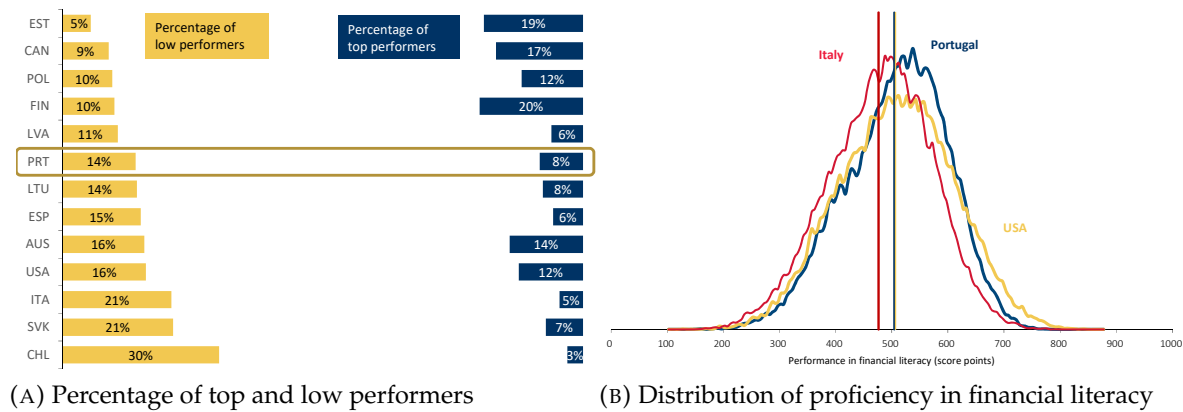(B) Distribution of proficiency in financial literacy

FIGURE 3: Financial literacy proficiency levels and proficiency score in selected countries

Source: OECD PISA 2018.
Notes: (A) Low performers have a proficiency level below two and top performers a proficiency level of five. (B) Histogram of performance using an interval size of five score points and a two interval moving-average as a smoothing procedure. Vertical lines depict mean values, with those for Portugal and the US overlapping each other.

## 3. How does teenagers' financial literacy interact with their demographic characteristics and social background?

*Parents' education*: The educational level of parents is measured as the highest educational attainment level of either parent, and the main cut-off used is upper secondary education (ISCED level three), corresponding in Portugal to the 12th grade. Despite the progress in years of schooling in the last decades, the percentage of parents without upper secondary education in the cohort of 15 years-old in Portugal is still high (32%), and significantly higher than in Italy (16%) or the US (8%).

The probability of students obtaining a low result in PISA decreases according to the education of the parent (Figure 4A). This difference is more striking in the US[4]. Another way of grasping the impact of parents' education on financial literacy is to look directly at the gap between the means of different types of students (Figure 5A). Portuguese students whose parents have below upper secondary education have, on average, less 48 points in the financial literacy score, around half of a standard deviation less than their peers.

*Resources at home*: The number of books at home has been widely used as an indirect measure of the resources available at home, socio-economic family

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4.  The inverse happens with the probability of students being top performers (proficiency level five), with the US appearing again with the highest difference.

(A) Parents' education   (B) Books at home
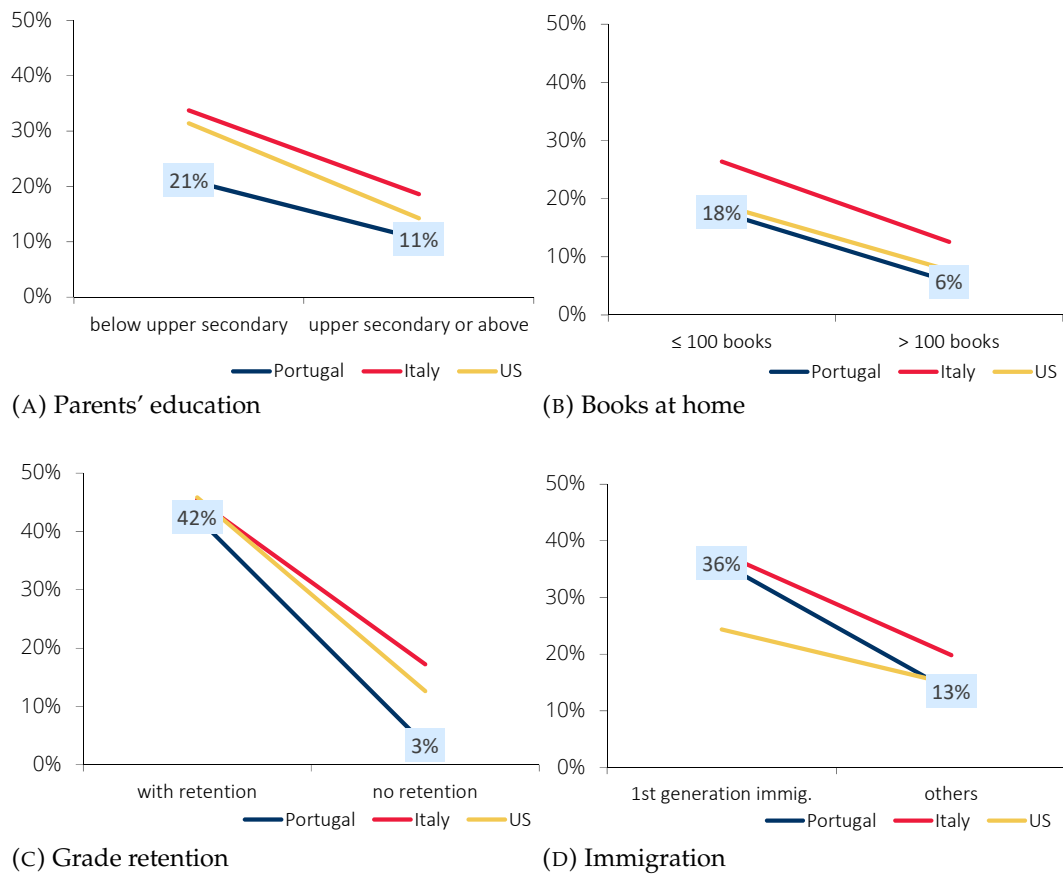
(C) Grade retention   (D) Immigration

FIGURE 4: Probability of being a low performer according to different characteristics
Source: OECD PISA 2018.
Note: Labels highlight the results for Portugal.

background and parenting style (Hanushek *et al.* 2016). Around 70% of the 15 years-old in Portugal have up to 100 books at home, a figure which is similar to the US and slightly higher than in Italy (61%).

The probability of finding a low performer in the group of students with a low number of books at home is three times higher in Portugal (18%) than for those with a high number of books at home (6%) (Figure 4B). Additionally, having fewer books at home is associated with a negative unconditional gap in financial literacy and the same can be found using a broader indicator of home possessions[5] (Figure 5A).

*School retention*: Grade retention is an indicator of severe difficulties in the past schooling experience and it can be seen as a proxy for the skills valued at school. This feature is much more prevalent in Portugal, as discussed in Pereira and Reis

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5.   The construction of the index of home possessions is detailed in appendix A.

(2014) (27% of 15 years-old students in Portugal, vis-à-vis 13 and 9% in Italy and the US, respectively).

Figure 4C shows that the probability of being a low performer in Portugal is 42% in the case of retained students, as opposed to only 3% for their peers. The unconditional gap in financial literacy for retained students is the most substantial from the ones depicted in Figure 5A reaching 121 in Portugal (1.3 times the standard deviation).

*Immigration*: Only around 3% of the 15 years-old in Portugal were born in a foreign country and have foreign parents (first generation immigrants), and a similar percentage was born in Portugal but both parents were born in a foreign country (second generation immigrants). Immigration is more relevant in the US, where first generation immigrants account for 6% of the 15 years-old and second generation ones for 18%.

Focusing on first-generation immigrants, the probability of an immigrant being a low performer in Portugal reaches 36%, vis-à-vis 13% for other students (Figure 4D). These immigrants score on average lower in financial literacy than native students and this difference is higher for Portugal (67 score points) than for the US (33 score points). The unconditional gap in financial literacy is much lower and not statistically significant for second-generation immigrants (Figure 5A).

*Gender*: The unconditional gender gap in financial literacy in Portugal is low, being significantly different from zero only in Italy (Figure 5A).

*Overall impact:* Using regression analysis, it is possible to estimate gaps in financial literacy for each of the above-mentioned features, controlling for the other characteristics, i.e. conditional gaps.

In a conditional setting, grade retention is by far the feature explaining the highest gap in financial literacy in Portugal (around 109 score points), and it has an important impact in Italy and the US as well (around 70 score points). This is not surprising given that it is a proxy for students skills in core subjects, which are highly correlated with the performance on financial literacy (Table C.1 in the appendix). The gaps according to parents' education and the number of books at home are reduced by around a third after including these controls. The US is the country with the highest gap explained by these two indicators (Figure 5B and regression results Table D.1 in the appendix).

The gap for first-generation immigrants in Portugal is significantly reduced when comparing to the unconditional one, and there is no significant gap regarding second-generation immigrants. The fact that a higher fraction of first generation

(A) Unconditional gap

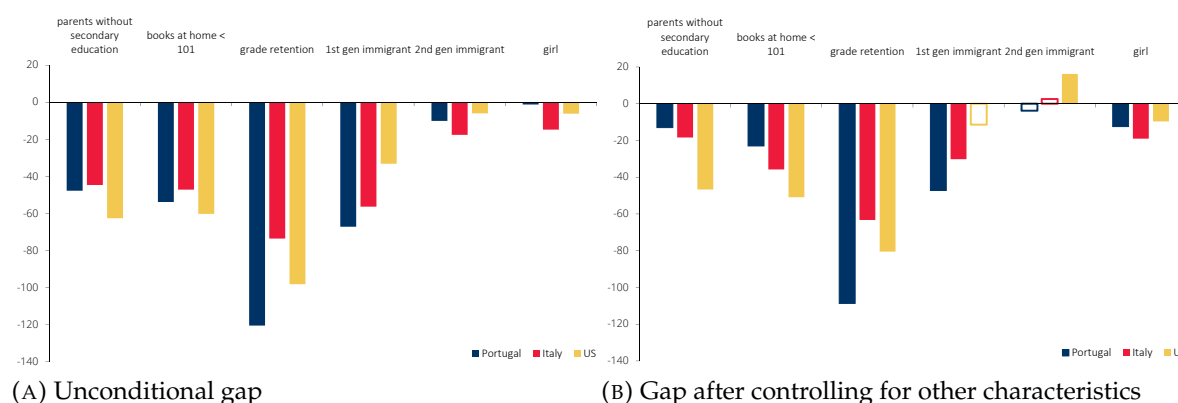(B) Gap after controlling for other characteristics

FIGURE 5: Gaps in financial literacy by demographic and socio-economic characteristics

Source: OECD PISA 2018.
Note: (A) The unconditional gap is the difference in the means of the two groups. Taking into account only non-missing observations for all variables in order to have the same sample as in B, changes the gaps by a maximum of 4 score points. (B) Filled bars with statistically significant results (p-value lower than 5%). Gaps based on a regression including all these variables along with controls for school type (private or public), school location in an urban setting and those cited under other considerations. Controlling for regions is only possible for Portugal and the US and results do not change significantly (Table D.1 in the appendix).

immigrants are being tested in a language that is not their mother tongue, could partially explain this result. However, when adding this variable to the regression for Portugal its coefficient has no statistical significance and the gap estimated for first-generation immigrants does not change much[6].

Girls have a lower performance than boys in all 3 countries after controlling for other characteristics. However, the estimated gaps remain small (around 10% of a standard deviation for Portugal and the US and 20% in Italy). When separately estimating the gaps for each gender in Portugal there is a stronger impact on the performance of girls in financial literacy from the socio-economic background, measured by the number of books at home (Table D.2 in the appendix).

*Other considerations*: The literature on financial literacy also discusses the role of parents occupations, and particularly mothers' occupation, on students' performance in this matter (Bottazzi and Lusardi 2021). One of the theories that justifies this discussion is based on the idea of an intergenerational transmission of gender roles, that would imply a higher impact from the characteristics of the mother on girls than boys (Olivetti *et al.* 2020).

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6. For Italy and the US, on the other hand, foreign language coefficient has high statistical significance and in Italy the impact for first-generation immigrants is reduced when adding that variable (Table D.3 in the appendix).

Even after controlling for all the above-mentioned characteristics, in Portugal the fact that the mother is a housewife is negatively correlated with financial literacy, and the inverse is true when the mother works in the financial sector[7]. However, if we analyse the results of separate regressions for boys and girls, in Portugal the effects are only clearly significant for boys, which does not confirm the hypotheses of the intergenerational transmission of gender roles as the main channel. Looking at Italy and the US, only for the former and in the case of mother housewife, the estimated coefficient is higher for girls, but the difference between the coefficients estimated for boys and girls is not statistically significant (Table D.2 in the appendix).

## 4. Financial experience, exposure to financial literacy at school and sources of financial information

### 4.1. Access to financial products

PISA also collects relevant information on other aspects related to financial literacy. Regarding access to financial products, almost 60% of the 15 years-old in Portugal made an online payment in the year preceding the questionnaire and 45% holds a bank account. Only around a quarter paid by phone in the same period or hold a payment or debit card (Figure 6A). The survey conducted by Banco de Portugal in 2020 (Banco de Portugal 2021) reaches similar conclusions regarding the proportion of youngsters (16-24 years-old) using phone payment, and highlights that the dissemination of this kind of payment is two times higher in this age cohort than in the rest of the population (above 24 years-old). In all these dimensions, except concerning the bank account, Portugal has a lower dissemination of these products among 15 years-old than Italy or the US.

One may expect that students with more access to financial products would achieve a higher financial literacy score. However, a regression analysis gives mixed signs. Impacts estimated are positive regarding holding a bank account, in Portugal and the US, and negative for using phone payment in all three countries, while for payment cards and online payments results are mixed[8] (Table D.4 in the appendix).

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7.   This variable is constructed using occupations from ISCO-08 codes 12 - administrative and commercial managers, 24 - business and administration professionals and 33 - Business and administration associate professionals.

8.   A principal component analysis was not more enlightening as, surprisingly, the highest correlation between the access to different financial products is only 0.34 (Table C.2 in the appendix).
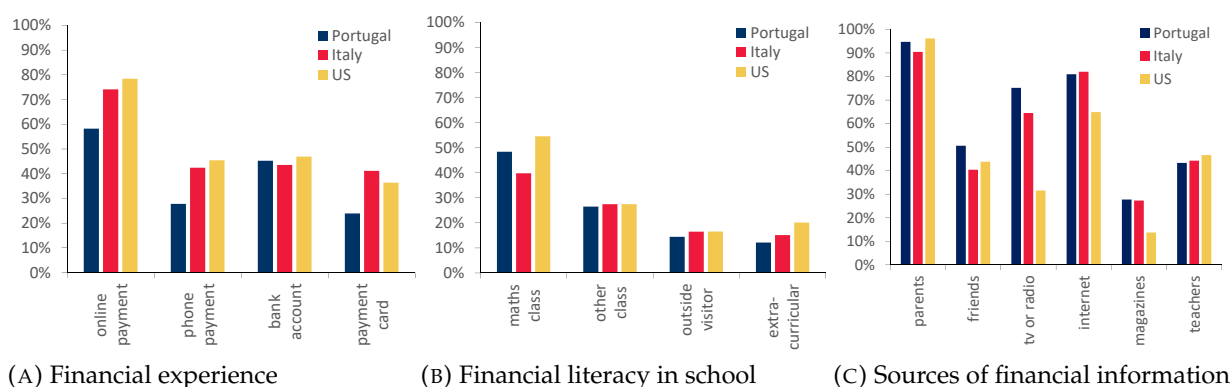
(A) Financial experience    (B) Financial literacy in school    (C) Sources of financial information

FIGURE 6: Additional information available in PISA
Source: OECD PISA 2018.

## 4.2. Exposure to financial literacy at school

Half of the students in Portugal acknowledged having discussed financial literacy questions in a mathematics class, a quarter in another class and around 15% in a one-off session from an outsider or in an extracurricular activity (Figure 6B). Controlling for student and school characteristics, those who discuss these questions in maths class score higher in Portugal and the US, the inverse happening when students say they discussed them in an extracurricular activity (Table D.5 in the appendix). However, as pointed by OECD (2020a), we cannot read these results as indicating that maths class is the better setting for improving financial literacy. In fact, it is expectable that the selection to the discussion of these topics outside classes would be far from random, as schools and students with significant financial literacy gaps can be especially targeted. A well-designed and consistent evaluation of the efforts to improve students' financial literacy in schools would be essential to ensure the efficiency on the allocation of public resources.

## 4.3. Sources of financial information

As regards the sources of information about money matters, parents are the most popular, being cited as a source by 95% of the Portuguese 15 years-old, followed by the internet and tv or radio (both around 80%). Around half of the students discuss these topics with teachers and friends and less than 30% look for this information in magazines (Figure 6C). Italy as a similar prevalence of the different sources, while in the US internet, magazines and especially tv or radio are less frequent sources of financial information. The predominance of discussions with parents signals a clear channel through which the intergenerational reproducibility of financial literacy gaps can be reinforced. Consequently, an investment in improving teenagers' skills

may yield a double dividend of improving their opportunities and allowing for a less uneven playing field for future generations. Discussing money matters with parents is related to a higher financial literacy score after controlling for other characteristics, and the same happens for the internet. On the other hand, magazines and, to a lower extend, also friends and teachers as information sources are connected with lower scores (Table D.5 in the appendix).

## 5. Regional differences regarding financial literacy

Although PISA has information on students' location according to very disaggregated territorial units[9] for Portugal, the sample size by region is very small and there is a huge uncertainty in estimating mean scores for these small regional units. We opted for using six regions but sample size is still small, which significantly constraints the depth of the analysis[10].

Students on the islands of *Açores* and *Madeira* and in *Alentejo* score significantly below the country average. This result is maintained if we control for the characteristics of students and their families discussed in section 3. In these regions there is also a higher percentage of students, one in every five, which are low performers, and are therefore considered by OECD as not having the basic financial literacy skills to make sound financial decisions even in contexts that are already immediately relevant to them (Figure 7).

Analysing the characteristics explaining the differences on financial literacy scores within each region, retention appears once again as the main driver. The estimated gap in financial literacy between retained and non-retained students, after controlling for students characteristics is particularly high in *Norte* and in the islands of *Açores* and *Madeira* (Figure 8B).

The explanatory power of parents' education and the socio-economic background, measured by the number of books at home, is again much more muted when controlling for other characteristics. The impact of having both parents with below upper secondary education or less than 101 books at home waves around 20 in a conditional setting, which compares to roughly 50 without conditioning. The estimated gender and immigrant gaps are relevant in *Área Metropolitana de Lisboa* and the gender gap is also relevant in the islands of *Açores* and *Madeira*, and in *Norte* (Figure 8).

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9.   Regional data is identified by the 25 NUTS (Nomenclature of Territorial Units for Statistics) III.

10.   We follow NUTS II disaggregation but add the information on the islands *Açores* and *Madeira* in a single regional unit. Sample size can be viewed in Table D.6 in the appendix.

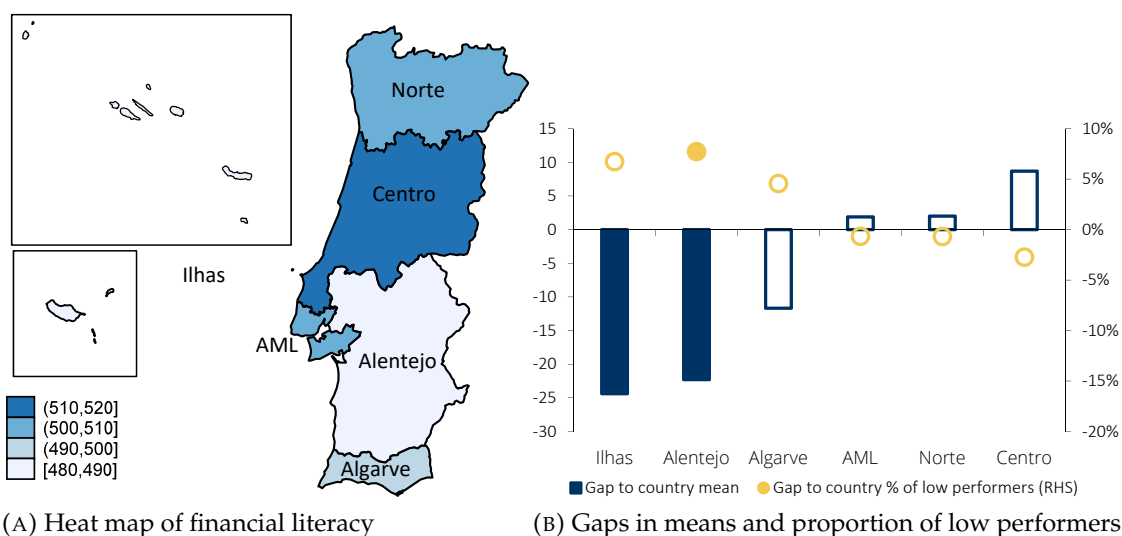| (A) Heat map of financial literacy | (B) Gaps in means and proportion of low performers |

FIGURE 7: Regional distribution of financial literacy in Portugal

Source: OECD PISA 2018.
Notes: AML stands for *Área Metropolitana de Lisboa* and *Ilhas* for the islands of *Açores* and *Madeira*. (A) The scale of the islands is different. (B) Filled bars and circles with statistically significant results.
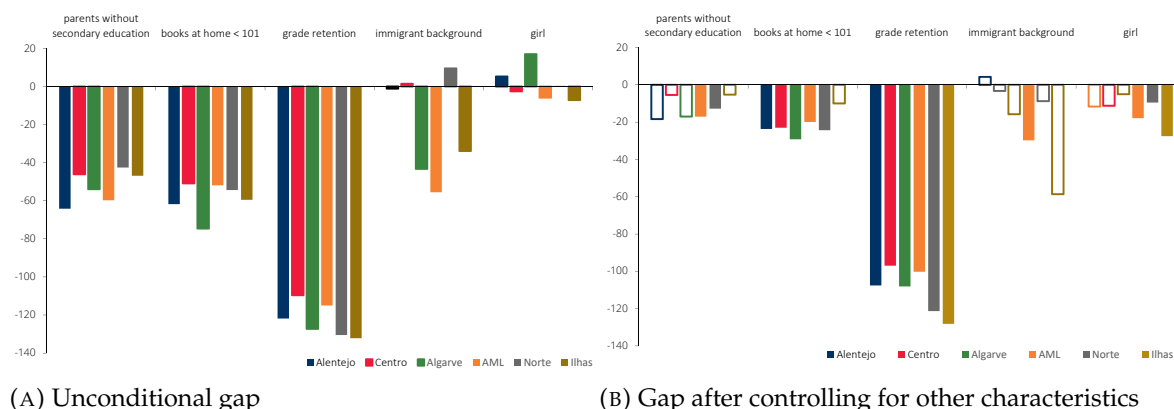


| (A) Unconditional gap | (B) Gap after controlling for other characteristics |

FIGURE 8: Regional gaps in financial literacy by demographic and socio-economic characteristics

Source: OECD PISA 2018.
Note: AML stands for *Área Metropolitana de Lisboa* and *Ilhas* for the islands of *Açores* and *Madeira*. (A) The unconditional gap is the difference in the means of the two groups. (B) Gaps based on a regression including all these variables along with controls for school type (private or public), school location in an urban setting and those cited under other considerations (Table D.6 in the appendix). Immigrant background includes first and second-generation immigrants because in some regions the number of immigrants is low. Filled bars with statistically significant results (p-value lower than 5%).

In what concerns financial experience, exposure to financial literacy at school and sources of financial information, there are some regional differences to highlight. As to access to financial products, *Alentejo* has a lower percentage of 15 years-old holding a bank account (38%) but a higher use of online payment (67%). In the islands of *Açores* and *Madeira* there is a lower proportion of teenagers holding payment cards (15%) while in *Centro* it is more common to hold a bank account

(51%). On the setting where financial literacy questions are discussed at school, the only statistically significant difference to the country average is found regarding the percentage of students reporting extracurricular activities that is lower in *Área Metropolitana de Lisboa* (8%) and higher in *Norte* (15%). Finally, for the sources of information regarding money matters, *Algarve* and the above-mentioned islands have lower percentages of tv or radio, respectively, 68% and 69%, while in *Área Metropolitana de Lisboa* students rely less on magazines (22%).

## 6. Concluding remarks

Financial literacy is a relevant public policy issue. Despite all the difficulties in measuring this phenomenon, PISA financial literacy assessment provides a very comprehensive picture of what Portuguese teenagers know and are able to correctly apply to different situations in this matter. Portugal performs better than Italy but worse than top performers Estonia and Finland. Data for future waves of this assessment including Portugal can be important to test the robustness of the findings presented in this paper. A higher country coverage would help to get a clearer picture of how our students compare as, for instance, the two largest euro area economies did not participate.

The results on financial literacy are highly correlated with those on mathematics and reading. Therefore, it is not surprising that students with severe difficulties in past schooling, which led to grade retention, have much lower financial literacy scores. Parents' educational attainment and socio-economic background also play a major role on the level of financial literacy, showing that there is a long way to go in providing equal opportunities to 15 years-old on this field.

There is a meaningful share of teenagers in Portugal with access to alternative sources of payment and financial products but, except for the bank account, the dissemination of these products is lower than in Italy or the US. As to exposure to financial literacy related topics at school, maths classes is the most common setting. The main sources of information about money matters are students' parents, the internet and tv or radio. At a regional level, *Alentejo* and the islands of *Açores* and *Madeira* taken together have lower levels of financial literacy, but a thorough analysis of regional data requires a more comprehensive sample. All these features should be taken into account when accessing how to improve financial literacy in this age group.

It would be interesting to enrich the findings of this paper by applying a similar methodology to the data from the OECD/INFE 2020 International Survey of Adult Financial Literacy. While the life cycle theory anticipates a higher appetite for

financial literacy in adults (and lower in young and old), there is a high heterogeneity in education attainment of different age cohorts in Portugal, which could also play a major role. Disentangling these factors is a topic for future research.

18

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20

## Appendix A: Details about OECD PISA 2018 financial literacy assessment

Researchers on the field of economics of education extensively use PISA. It is based on very elaborate sampling, as both schools and then students within them are chosen using a random process that takes into account their characteristics. Moreover, it uses complex test design and multiple imputation, as not all students respond to all questions in the survey (OECD 2020b). Both sampling and imputation errors can be taken into account in the econometric estimations by considering replicate weights and the 10 plausible values of each students' test score provided by OECD and that is done in this paper using a specific Stata module (Avvisati and Keslair 2014).

OECD constructs an index of home possessions, taking into account three sets of questions regarding: 1) access for studying to 19 different items at home (e.g. a desk); 2) availability of 9 home possessions (e.g. a car); 3) number of books at home.

| Level | Lower score limit | What students can typically do |
|---|---|---|
| 5 | 625 | Students can apply their understanding of a wide range of financial terms and concepts to contexts that may only become relevant to their lives in the long term. They can analyse complex financial products and can take into account features of financial documents that are significant but unstated or not immediately evident, such as transaction costs. They can work with a high level of accuracy and solve non-routine financial problems, and they can describe the potential outcomes of financial decisions, showing an understanding of the wider financial landscape, such as income tax. |
| 4 | 550 | Students can apply their understanding of less common financial concepts and items to contexts that will be relevant to them as they move towards adulthood, such as bank account management and compound interest in savings products. They can interpret and evaluate a range of detailed financial documents, such as bank statements, and explain the functions of less commonly used financial products. They can make financial decisions taking into account longer-term consequences, such as understanding the overall cost implication of paying back a loan over a longer period, and they can solve routine problems in less common financial contexts. |
| 3 | 475 | Students can apply their understanding of commonly used financial concepts, terms, and products to situations that are relevant to them. They begin to consider the consequences of financial decisions and they can make simple financial plans in familiar contexts. They can make straightforward interpretations of a range of financial documents and can apply a range of basic numerical operations, including calculating percentages. They can choose the numerical operations needed to solve routine problems in relatively common financial literacy contexts, such as budget calculations. |
| 2 | 400 | Students begin to apply their knowledge of common financial products and commonly used financial terms and concepts. They can use given information to make financial decisions in contexts that are immediately relevant to them. They can recognise the value of a simple budget and can interpret prominent features of everyday financial documents. They can apply single basic numerical operations, including division, to answer financial questions. They show an understanding of the relationships between different financial elements, such as the amount of use and the costs incurred. |
| 1 | 326 | Students can identify common financial products and terms and interpret information relating to basic financial concepts. They can recognise the difference between needs and wants and can make simple decisions on everyday spending. They can recognise the purpose of everyday financial documents, such as an invoice, and apply single and basic numerical operations (addition, subtraction or multiplication) in financial contexts that they are likely to have experienced personally. |

FIGURE A.1: Financial literacy proficiency levels and related tasks
Source: OECD (2020a).
Note: Students in proficiency level zero are those that typically cannot perform the tasks described in 1.

# Appendix B: Descriptive statistics

| | Portugal | | Italy | | US | | Alentejo | | Centro | | Algarve | | AML | | Norte | | Ihas | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Mean** | SD | **Mean** | SD | **Mean** | SD | **Mean** | SD | **Mean** | SD | **Mean** | SD | **Mean** | SD | **Mean** | SD | **Mean** | SD |
| Financial literacy | 505.4 | 90.6 | 476.5 | 92.0 | 505.7 | 101.8 | 483.1 | 95.7 | 514.0 | 87.3 | 493.7 | 93.9 | 507.2 | 90.7 | 507.4 | 89.6 | 481.0 | 91.9 |
| Girl | 49% | 50% | 49% | 50% | 50% | 50% | 47% | 50% | 50% | 50% | 50% | 50% | 49% | 50% | 50% | 50% | 49% | 50% |
| Grade retention | 27% | 44% | 13% | 34% | 9% | 29% | 35% | 48% | 29% | 45% | 37% | 48% | 28% | 45% | 22% | 41% | 34% | 47% |
| Parents without upper secondary education | 32% | 47% | 16% | 36% | 8% | 28% | 26% | 44% | 31% | 46% | 19% | 39% | 23% | 42% | 40% | 49% | 40% | 49% |
| Number of books at home <101 | 69% | 46% | 61% | 49% | 71% | 45% | 67% | 47% | 65% | 48% | 66% | 47% | 63% | 48% | 77% | 42% | 80% | 40% |
| First generation immigrant | 3% | 16% | 4% | 20% | 6% | 24% | 2% | 13% | 1% | 11% | 6% | 24% | 6% | 24% | 1% | 10% | 1% | 12% |
| Second generation immigrant | 4% | 21% | 6% | 23% | 18% | 38% | 2% | 15% | 3% | 18% | 9% | 28% | 9% | 29% | 2% | 13% | 1% | 10% |
| Foreign language | 7% | 25% | 20% | 40% | 17% | 37% | 3% | 18% | 5% | 23% | 7% | 26% | 12% | 32% | 1% | 12% | 26% | 44% |
| Urban school | 26% | 44% | 28% | 45% | 41% | 49% | 0% | 0% | 8% | 27% | 12% | 32% | 50% | 50% | 23% | 42% | 36% | 48% |
| Private school | 15% | 36% | 5% | 22% | 7% | 26% | 15% | 36% | 17% | 37% | 0% | 0% | 21% | 41% | 12% | 33% | 2% | 14% |
| Mother housewife | 3% | 18% | 22% | 41% | 5% | 22% | 3% | 16% | 3% | 17% | 0% | 0% | 2% | 14% | 5% | 21% | 9% | 28% |
| Mother financial | 10% | 30% | 6% | 24% | 12% | 33% | 9% | 29% | 8% | 27% | 8% | 26% | 15% | 35% | 9% | 28% | 5% | 23% |
| | | | | | | | | | | | | | | | | | | |
| Source of financial information: | | | | | | | | | | | | | | | | | | |
| Parents | 95% | 22% | 90% | 29% | 96% | 19% | 94% | 24% | 96% | 20% | 90% | 30% | 95% | 22% | 95% | 22% | 91% | 29% |
| Friends | 51% | 50% | 40% | 49% | 44% | 50% | 56% | 50% | 51% | 50% | 49% | 50% | 50% | 50% | 50% | 50% | 53% | 50% |
| Tv or radio | 75% | 43% | 64% | 48% | 32% | 46% | 75% | 44% | 76% | 42% | 68% | 47% | 74% | 44% | 77% | 42% | 69% | 46% |
| Internet | 81% | 39% | 82% | 38% | 65% | 48% | 81% | 40% | 83% | 37% | 78% | 42% | 78% | 41% | 82% | 38% | 81% | 40% |
| Magazines | 28% | 45% | 27% | 45% | 14% | 34% | 33% | 47% | 28% | 45% | 34% | 47% | 22% | 42% | 30% | 46% | 30% | 46% |
| Teachers | 43% | 50% | 44% | 50% | 47% | 50% | 42% | 49% | 44% | 50% | 46% | 50% | 41% | 49% | 45% | 50% | 45% | 50% |
| | | | | | | | | | | | | | | | | | | |
| Exposure to financial education in school in: | | | | | | | | | | | | | | | | | | |
| Math class | 48% | 50% | 40% | 49% | 55% | 50% | 48% | 50% | 51% | 50% | 44% | 50% | 49% | 50% | 47% | 50% | 45% | 50% |
| Other class | 27% | 44% | 27% | 45% | 27% | 45% | 25% | 44% | 26% | 44% | 17% | 38% | 27% | 44% | 28% | 45% | 27% | 45% |
| Outside visitor | 14% | 35% | 16% | 37% | 17% | 37% | 15% | 35% | 15% | 36% | 18% | 39% | 13% | 34% | 14% | 35% | 18% | 38% |
| Extracurricular | 12% | 33% | 15% | 36% | 20% | 40% | 13% | 34% | 12% | 32% | 9% | 29% | 8% | 28% | 15% | 35% | 18% | 39% |
| | | | | | | | | | | | | | | | | | | |
| Experience in managing money | | | | | | | | | | | | | | | | | | |
| Online payment | 58% | 49% | 74% | 44% | 78% | 41% | 67% | 47% | 60% | 49% | 65% | 48% | 57% | 50% | 56% | 50% | 55% | 50% |
| Phone payment | 28% | 45% | 42% | 49% | 45% | 50% | 29% | 45% | 26% | 44% | 39% | 49% | 24% | 43% | 29% | 46% | 34% | 47% |
| Bank account | 45% | 50% | 44% | 50% | 47% | 50% | 38% | 48% | 51% | 50% | 39% | 49% | 41% | 49% | 48% | 50% | 42% | 49% |
| Payment card | 24% | 43% | 41% | 49% | 36% | 48% | 26% | 44% | 25% | 44% | 26% | 44% | 26% | 44% | 22% | 41% | 15% | 36% |

TABLE B.1.  Descriptive statistics

Notes: AML stands for *Área Metropolitana de Lisboa* and *Ilhas* for the islands of *Açores* and *Madeira*.

# Appendix C: Correlations

| | Math | Reading | Fin Lit | Girl | Retention | Parents educ | Books | 1st gen | 2nd gen | Urban | Private | Mother HW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reading | 0.84 | | | | | | | | | | | |
| Fin Lit | 0.88 | 0.85 | | | | | | | | | | |
| Girl | -0.05 | 0.12 | -0.02 | | | | | | | | | |
| Grade retention | -0.60 | -0.58 | -0.58 | -0.08 | | | | | | | | |
| Parent without upper secondary education | -0.26 | -0.24 | -0.25 | 0.00 | 0.24 | | | | | | | |
| Number of books at home <101 | -0.30 | -0.31 | -0.27 | -0.03 | 0.23 | 0.28 | | | | | | |
| First generation immigrant | -0.13 | -0.11 | -0.12 | -0.01 | 0.06 | -0.02 | 0.03 | | | | | |
| Second generation immigrant | -0.04 | -0.03 | -0.02 | 0.00 | 0.03 | -0.03 | -0.11 | -0.04 | | | | |
| Urban school | 0.15 | 0.16 | 0.14 | 0.04 | -0.13 | -0.14 | -0.06 | 0.05 | 0.09 | | | |
| Private school | 0.06 | 0.03 | 0.04 | -0.02 | -0.10 | -0.06 | 0.05 | -0.03 | -0.03 | 0.09 | | |
| Mother housewife | -0.08 | -0.09 | -0.09 | 0.02 | 0.04 | 0.11 | -0.09 | -0.01 | 0.10 | -0.03 | -0.01 | |
| Mother financial occupation | 0.15 | 0.15 | 0.15 | -0.01 | -0.13 | -0.19 | -0.04 | -0.03 | -0.01 | 0.10 | 0.08 | -0.07 |

TABLE C.1. Correlation main variables - Portugal

| | FinLit | parents | friends | tv/radio | internet | mag. | teachers | maths | other | outside | extracurric. | online pay | phone pay | bank account |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parents | 0.16 | | | | | | | | | | | | | |
| Friends | -0.11 | 0.06 | | | | | | | | | | | | |
| Tv or radio | 0.06 | 0.12 | 0.08 | | | | | | | | | | | |
| Internet | 0.07 | 0.09 | 0.13 | 0.30 | | | | | | | | | | |
| Magazines | -0.13 | 0.01 | 0.18 | 0.25 | 0.21 | | | | | | | | | |
| Teachers | -0.07 | 0.06 | 0.13 | 0.12 | 0.13 | 0.18 | | | | | | | | |
| Mathematics class | 0.05 | 0.07 | 0.03 | 0.02 | 0.05 | 0.01 | 0.17 | | | | | | | |
| Other class | 0.04 | 0.04 | 0.08 | 0.09 | 0.09 | 0.11 | 0.17 | 0.17 | | | | | | |
| Outside visitor | -0.07 | 0.02 | 0.10 | 0.06 | 0.04 | 0.11 | 0.17 | 0.17 | 0.26 | | | | | |
| Extracurricular | -0.08 | 0.04 | 0.09 | 0.02 | 0.05 | 0.09 | 0.04 | 0.17 | 0.21 | 0.40 | | | | |
| Online payment | 0.06 | 0.02 | 0.07 | 0.01 | 0.12 | 0.06 | 0.03 | 0.04 | 0.08 | 0.05 | 0.03 | | | |
| Phone payment | -0.11 | 0.00 | 0.09 | -0.01 | 0.05 | 0.13 | 0.02 | 0.03 | 0.08 | 0.13 | 0.12 | 0.34 | | |
| Bank account | 0.20 | 0.08 | -0.03 | 0.06 | 0.04 | 0.02 | 0.03 | 0.02 | 0.06 | 0.04 | 0.05 | 0.05 | 0.01 | |
| Payment card | -0.01 | 0.02 | 0.04 | -0.02 | 0.01 | 0.04 | 0.26 | 0.03 | 0.05 | 0.07 | 0.09 | 0.14 | 0.15 | 0.20 |

TABLE C.2. Correlation other aspects related to financial literacy - Portugal

# Appendix D: Regression results - financial literacy score as dependent variable

| | Portugal | | Italy | US | |
|---|---|---|---|---|---|
| Regional controls | no | yes | no | no | yes |
| Girl | -12.45*** | -12.83*** | -19.04*** | -9.62** | -9.47** |
| | 3.06 | 3 | 2.99 | 3.65 | 3.65 |
| Grade retention | -108.71*** | -108.37*** | -63.28*** | -80.47*** | -78.16*** |
| | 3.73 | 3.77 | 5.3 | 6.43 | 6.48 |
| Parents without upper secondary education | -13*** | -12.27*** | -18.38*** | -46.7*** | -47.78*** |
| | 3.56 | 3.61 | 4.17 | 6.44 | 6.42 |
| Number of books at home <101 | -23.01*** | -21.52*** | -35.8*** | -50.89*** | -49.22*** |
| | 3.06 | 3 | 3.19 | 4.36 | 4.35 |
| First generation immigrant | -47.27*** | -47.82*** | -30.18*** | -11.39 | -14.67* |
| | 10.17 | 10.13 | 8.49 | 7.44 | 7.66 |
| Second generation immigrant | -3.8 | -4.26 | 2.55 | 16.21** | 13.41** |
| | 8.94 | 8.71 | 7.38 | 6.65 | 6.31 |
| Urban school | 11.47** | 12.7** | 8.65 | 0.98 | 1.37 |
| | 4.63 | 5.28 | 6.96 | 6.64 | 7.63 |
| Private school | -9.4 | -11.06* | -25.28** | 1.33 | 5.31 |
| | 6.14 | 5.92 | 11.57 | 9.97 | 10.8 |
| Mother housewife | -23.3*** | -19.85** | -31.98*** | -11.11 | -13.42* |
| | 7 | 6.97 | 4.02 | 7.41 | 7.31 |
| Mother financial occupation | 13.34** | 13.29** | 20.94*** | 20.95*** | 20.34*** |
| | 4.55 | 4.6 | 5.3 | 5.72 | 5.72 |
| Constant | 561.96*** | 563.99*** | 526.54*** | 556.61*** | 551.75*** |
| | 3.53 | 5.5 | 4.45 | 5.45 | 7.76 |
| | | | | | |
| R2 | 0.38 | 0.4 | 0.18 | 0.16 | 0.16 |
| Observations | 4164 | 4164 | 8614 | 3267 | 3267 |

TABLE D.1. Results for Portugal, Italy and the US

Notes: regional controls at NUTS III level in Portugal and covering four regions in the US: Midwest, Northeast, South and West. p-values: * <0.1; ** <0.05; *** <0.01.

| | Portugal | | Italy | | US | |
|---|---|---|---|---|---|---|
| | Boys | Girls | Boys | Girls | Boys | Girls |
| Grade retention | -114.27*** | -103.57*** | -68.55*** | -55.71*** | -71.38*** | -92.09*** |
| | 4.94 | 5.42 | 7.61 | 5.96 | 8.41 | 9.22 |
| Parents without upper secondary education | -7.32 | -18.19*** | -21.43*** | -14.95** | -59*** | -33.88*** |
| | 4.58 | 4.66 | 5.96 | 4.88 | 10.19 | 9.59 |
| Number of books at home <101 | -14.45** | -30.33*** | -35.57*** | -35.96*** | -48.44*** | -53.26*** |
| | 4.69 | 4.43 | 4.06 | 3.8 | 6.37 | 6 |
| First generation immigrant | -36.75** | -56.97*** | -21.53* | -39.32*** | -14.73 | -6.52 |
| | 14.31 | 14.27 | 12.46 | 9.51 | 10.45 | 10.11 |
| Second generation immigrant | 0.96 | -5.91 | 14.83 | -10.37 | 22.29** | 9.69 |
| | 12 | 9.3 | 11.82 | 8.55 | 7.78 | 8.43 |
| Urban school | 17.21** | 5.79 | 3.71 | 13.92** | -4.38 | 5.88 |
| | 5.85 | 5.59 | 8.77 | 6.81 | 7.44 | 7.55 |
| Private school | -15.05** | -3.6 | -18.78 | -34.78** | 1.25 | 1.99 |
| | 7 | 7.43 | 14.53 | 10.64 | 14.33 | 9.16 |
| Mother housewife | -34.18*** | -14.2 | -29.34*** | -34.12*** | -7.93 | -13.58 |
| | 10.29 | 10.95 | 5.34 | 5.05 | 9.24 | 13.46 |
| Mother financial occupation | 16.24** | 10.07* | 22.93** | 19.23** | 26.34** | 16.07** |
| | 6.46 | 5.98 | 7.53 | 7.03 | 8.74 | 7.37 |
| Constant | 554.77*** | 556.11*** | 526.91*** | 506.88*** | 555.4*** | 548.1*** |
| | 5.55 | 3.76 | 5.21 | 4.15 | 6.74 | 5.68 |
| | | | | | | |
| R2 | 0.4 | 0.38 | 0.16 | 0.19 | 0.15 | 0.17 |
| Observations | 2078 | 2086 | 4354 | 4260 | 1621 | 1646 |

TABLE D.2. Results for boys and girls

Notes: p-values: * <0.1; ** <0.05; *** <0.01.

| | Portugal | | Italy | | US | |
|---|---|---|---|---|---|---|
| | baseline | incl. lang. | baseline | incl. lang. | baseline | incl. lang. |
| Girl | -12.45*** | -12.44*** | -19.04*** | -19.65*** | -9.62** | -9.2** |
| | 3.06 | 3.05 | 2.99 | 3.02 | 3.65 | 3.64 |
| Grade retention | -108.71*** | -108.53*** | -63.28*** | -62.57*** | -80.47*** | -81.04*** |
| | 3.73 | 3.74 | 5.3 | 5.33 | 6.43 | 6.51 |
| Parents without upper secondary education | -13*** | -13.08*** | -18.38*** | -16.73*** | -46.7*** | -42.99*** |
| | 3.56 | 3.56 | 4.17 | 3.98 | 6.44 | 6.38 |
| Number of books at home <101 | -23.01*** | -22.91*** | -35.8*** | -34.87*** | -50.89*** | -50.15*** |
| | 3.06 | 3.07 | 3.19 | 3.24 | 4.36 | 4.38 |
| First generation immigrant | -47.27*** | -42.18*** | -30.18*** | -20.73*** | -11.39 | 2.43 |
| | 10.17 | 9.91 | 8.49 | 8.81 | 7.44 | 8.47 |
| Second generation immigrant | -3.8 | -0.87 | 2.55 | 9.57 | 16.21** | 24.38** |
| | 8.94 | 8.8 | 7.38 | 7.42 | 6.65 | 7.51 |
| Urban school | 11.47** | 11.63** | 8.65 | 8.36 | 0.98 | 1.5 |
| | 4.63 | 4.62 | 6.96 | 6.92 | 6.64 | 6.61 |
| Private school | -9.4 | -9.34 | -25.28** | -24.05** | 1.33 | 1.83 |
| | 6.14 | 6.16 | 11.57 | 11.57 | 9.97 | 10.16 |
| Mother housewife | -23.3*** | -23.42*** | -31.98*** | -31.26*** | -11.11 | -10.62 |
| | 7 | 7.01 | 4.02 | 4 | 7.41 | 7.4 |
| Mother financial occupation | 13.34** | 13.16** | 20.94*** | 20.59*** | 20.95*** | 20.45*** |
| | 4.55 | 4.57 | 5.3 | 5.3 | 5.72 | 5.77 |
| Foreign language | | -17.29 | | -17.35*** | | -19.22** |
| | | 11.44 | | 4.47 | | 6.59 |
| Constant | 561.96*** | 561.99*** | 526.54*** | 528.22*** | 556.61*** | 556.2*** |
| | 3.53 | 3.54 | 4.45 | 4.53 | 5.45 | 5.49 |
| R2 | 0.38 | 0.39 | 0.18 | 0.18 | 0.16 | 0.16 |
| Observations | 4164 | 4164 | 8614 | 8614 | 3267 | 3267 |

TABLE D.3. Adding foreign language

Notes: p-values: * <0.1; ** <0.05; *** <0.01.

|                                             | Portugal    | Italy      | US          |
|---------------------------------------------|-------------|------------|-------------|
| Girl                                        | -15.3***    | -21.94***  | -13.45***   |
|                                             | 3.1         | 3.43       | 3.83        |
| Grade retention                             | -100.03***  | -55.37***  | -76.98***   |
|                                             | 3.68        | 5.91       | 6.6         |
| Parents without upper secondary education   | -14.38***   | -12.62**   | -40.03***   |
|                                             | 3.56        | 4.79       | 6.61        |
| Number of books at home <101                | -23.36***   | -29.7***   | -42.81***   |
|                                             | 3           | 3.16       | 4.64        |
| First generation immigrant                  | -44.68***   | -25.3**    | -1.41       |
|                                             | 11.32       | 9.28       | 8.26        |
| Second generation immigrant                 | 0.39        | -2.48      | 19.45**     |
|                                             | 9.43        | 7.65       | 6.61        |
| Urban school                                | 8.72*       | 6.96       | 3.92        |
|                                             | 4.49        | 7.05       | 6.43        |
| Private school                              | -8.09       | -26.32**   | -5.19       |
|                                             | 6.01        | 12.01      | 9.08        |
| Mother housewife                            | -17.93**    | -27.21***  | -5.88       |
|                                             | 7.82        | 4.26       | 7.19        |
| Mother financial occupation                 | 9.16**      | 18.02***   | 20.44***    |
|                                             | 4.41        | 5.38       | 5.66        |
| Online payment                              | 5.56*       | 28.73***   | 33.63***    |
|                                             | 3.03        | 3.8        | 4.06        |
| Phone payment                               | -19.54***   | -21.85***  | -22.28***   |
|                                             | 3.45        | 3.56       | 4.33        |
| Bank account                                | 16.9***     | 2.44       | 26.72***    |
|                                             | 2.7         | 3.1        | 4.4         |
| Payment card                                | -6.69**     | 13.15***   | -7.34*      |
|                                             | 3.24        | 3.12       | 4.44        |
| Constant                                    | 561.27***   | 508.79***  | 525.7***    |
|                                             | 4.56        | 5.45       | 6.83        |
|                                             |             |            |             |
| R2                                          | 0.39        | 0.19       | 0.2         |
| Observations                                | 3832        | 6935       | 3045        |

TABLE D.4. Experience in managing money

Notes: p-values: * <0.1; ** <0.05; *** <0.01.

| | Portugal | Italy | US | Portugal | Italy | US |
|---|---|---|---|---|---|---|
| Girl | -12.2*** | -24.33*** | -12.94*** | -11.51*** | -20.7*** | -13.07*** |
| | 3.17 | 3.16 | 3.63 | 3.15 | 3.25 | 3.78 |
| Grade retention | -100.43*** | -59.38*** | -72.5*** | -103.71*** | -62.9*** | -78.16*** |
| | 3.83 | 5.38 | 6.96 | 3.78 | 5.48 | 7.08 |
| Parents without upper secondary education | -14.53*** | -11.54** | -47.28*** | -14.69*** | -17.5*** | -45.16*** |
| | 3.45 | 3.98 | 6.3 | 3.58 | 4.4 | 6.53 |
| Number of books at home <101 | -22.49*** | -29.41*** | -46.97*** | -23.01*** | -34.93*** | -49.82*** |
| | 2.89 | 3.3 | 4.39 | 3.08 | 3.46 | 4.46 |
| First generation immigrant | -37.3*** | -26.33** | -8.33 | -46.43*** | -28.73** | -11.83 |
| | 11.19 | 8.88 | 7.04 | 11.61 | 9.25 | 7.74 |
| Second generation immigrant | -7.02 | 1.03 | 13.26** | -4.64 | -1.1 | 12.88* |
| | 9.76 | 7.36 | 6.2 | 9.46 | 7.33 | 6.96 |
| Urban school | 7.99* | 7.27 | 2.77 | 10.29** | 9.22 | 1.55 |
| | 4.38 | 6.3 | 6.27 | 4.56 | 6.84 | 6.43 |
| Private school | -8.56 | -25.84** | 2.08 | -9.24 | -25.7** | -4.92 |
| | 5.91 | 9.65 | 8.27 | 5.95 | 11.13 | 8.16 |
| Mother housewife | -21.25** | -28.03*** | -7.65 | -20.96** | -31.04*** | -11.21 |
| | 7.59 | 4.06 | 7.85 | 7.45 | 4.36 | 7.72 |
| Mother financial occupation | 11.45** | 15.76** | 22.39*** | 13.45** | 21.21*** | 21.27*** |
| | 4.35 | 5.29 | 5.45 | 4.51 | 5.52 | 5.69 |
| **Source of financial information:** | | | | | | |
| Parents | 30.81*** | 33.49*** | 21.46** | | | |
| | 6.48 | 5.52 | 8.84 | | | |
| Friends | -9.73** | -9.85*** | -8** | | | |
| | 3.19 | 2.92 | 3.5 | | | |
| Tv or radio | 4.26 | -9.6** | -24.88*** | | | |
| | 3.23 | 3.64 | 4.16 | | | |
| Internet | 10.58** | 21.94*** | 27.81*** | | | |
| | 4.29 | 3.95 | 4.54 | | | |
| Magazines | -18.21*** | -24.98*** | -33.56*** | | | |
| | 3.05 | 3.72 | 6.68 | | | |
| Teachers | -7.14** | -13.97*** | -8.77** | | | |
| | 2.72 | 3.57 | 3.49 | | | |
| **Exposure to financial education at school in:** | | | | | | |
| Maths class | | | | 9.51*** | 4.44 | 27.58*** |
| | | | | 2.59 | 3.47 | 3.9 |
| Other class | | | | -1.44 | 3.97 | -2.57 |
| | | | | 3.24 | 3.55 | 4.53 |
| Outside visitor | | | | -6.66 | -12.62** | -31.41*** |
| | | | | 4.22 | 5.42 | 6.24 |
| Extracurricular | | | | -9.5** | -15.39** | -10.23** |
| | | | | 4.29 | 4.91 | 4.88 |
| Constant | 535.46*** | 502.81*** | 536.82*** | 561.27*** | 532.5*** | 552.48*** |
| | 7.17 | 7.2 | 10.66 | 4.09 | 4.42 | 5.45 |
| | | | | | | |
| R2 | 0.39 | 0.22 | 0.2 | 0.37 | 0.18 | 0.19 |
| Observations | 3879 | 7826 | 3138 | 3866 | 7689 | 3094 |

TABLE D.5. Sources of financial information and exposure to financial education in school

Notes: p-values: * <0.1; ** <0.05; *** <0.01.

27

|  | Alentejo | Centro | Algarve | AML | Norte | Islands |
|---|---|---|---|---|---|---|
| Girl | -11.65* | -11.23* | -5.02 | -17.88** | -9.49** | -27.49** |
|  | 6.91 | 6.11 | 16.34 | 5.8 | 4.53 | 10.7 |
| Grade retention | -107.59*** | -96.99*** | -108.1*** | -100.22*** | -121.33*** | -128.15*** |
|  | 9.66 | 6.95 | 16.99 | 6.69 | 7.14 | 12.83 |
| Parents without upper secondary education | -18.37 | -5.43 | -17.01 | -17.04** | -12.76** | -5.27 |
|  | 11.23 | 6.04 | 15.32 | 7.07 | 6.26 | 10.35 |
| Number of books at home <101 | -23.65** | -22.98*** | -29.2** | -19.92** | -24.3*** | -9.98 |
|  | 8.68 | 5.82 | 12.95 | 6.35 | 5.52 | 15.96 |
| Immigrant background | 4.25 | -3.28 | -15.76 | -29.74** | -8.75 | -58.65 |
|  | 16.72 | 17.79 | 17.66 | 10.21 | 13.06 | 49.12 |
| Urban school |  | 25.66** | 0.73 | 10.14 | 17.65** | 4.32 |
|  |  | 9.9 | 12.09 | 8.17 | 8.42 | 11.68 |
| Private school | -35.12 | -9.53 |  | -4.62 | -15.16 |  |
|  | 24.15 | 11.72 |  | 9.63 | 13.12 |  |
| Mother housewife | -25.73 | -36.25** |  | -19.54 | -11.36 | -19.7 |
|  | 16.38 | 14.58 |  | 19.47 | 10.35 | 17.46 |
| Mother financial occupation | 19.93** | 7.18 | -7.71 | 12.41 | 18.24** | 25.33 |
|  | 7.59 | 8.76 | 31.08 | 8.16 | 7.44 | 21.02 |
| Constant | 553.45*** | 566.19*** | 564.83*** | 561.27*** | 560.25*** | 550.55*** |
|  | 6.55 | 6.29 | 12.39 | 8.93 | 5.22 | 20.31 |
| R2 | 0.4 | 0.35 | 0.45 | 0.36 | 0.41 | 0.48 |
| Observations | 550 | 954 | 128 | 804 | 1559 | 169 |

TABLE D.6. Results by region in Portugal

Notes: AML stands for *Área Metropolitana de Lisboa* and *Ilhas* for the islands of *Açores* and *Madeira*. Some coefficients are not estimated because they are constant in the respective regions. p-values: * <0.1; ** <0.05; *** <0.01.

# Non-technical summary

## The competitiveness of the Portuguese economy: A view from a composite indicator

*João Amador, Ana Fernandes and Guida Nogueira*

Economic policy debate often focuses on competitiveness and the determinants of long-term economic growth. In Portugal, the discussion on long term growth, competitiveness and structural reform is also present and it is exacerbated by the need to resume the convergence process vis-à-vis the EU average.

Competitiveness is a diffuse concept, and its quantification encompasses a very wide range of phenomena. Therefore, it's measurement requires many indicators of different types. Such a multidimensional problem poses significant challenges, notably in terms of aggregating information and communicating a straightforward message. The classic way of assessing competitive conditions relies on scoreboards, but in recent years composite indicators became popular tools. Nevertheless, their design should take into account some aspects. Firstly, countries undergo structural reforms simultaneously. Therefore, it is necessary to define an indicator that assesses a countries' relative performance within a reference group. Another relevant issue concerns the weighting of individual indicators in order to produce a single competitiveness indicator. Results may differ according do the choice of weights, thus rosbustness bands are useful.

Having all the above considerations in mind, this article analyses the competitive conditions in Portugal using a new composite competitiveness indicator (ICC) that combines annual cross-country aggregated data on a set of competitiveness-related variables. We define four broad dimensions of competitiveness, namely: i) Macroeconomic stability and income distribution; ii) Education and innovation; iii) Investment and infrastructure; iv) Institutions and markets. The ICC adopts a simple metric to measure the gap of each country comparing to the best performance observed for each competitiveness-related variable, across the EU Member-states. In addition, in order to obtain robustness bands, we randomize weights and recalculate the indicator for each draw.

Figure 1 presents the ICC for Portugal in the period 1995-2020, as well as for a selected set of EU countries. In Portugal, the ICC presented a downward trajectory until 2007. However, between 2014 and 2020 there was a recovery and the ICC returned to levels similar to those existing in 1995. It is worth highlighting that results for 2020, which reflect the early impact of the COVID-19 pandemics, show a rise in the composite indicator, signaling that this shock may not have hurt the competitiveness of the Portuguese economy.

Institutions and markets is the dimension with the highest level among the four considered. Despite the very strong decrease observed until 2010, there was a partial recovery up to 2020. The levels observed for the other three dimensions in 2020 are quite similar. Nevertheless, their path taken since 1995 was quite different. The macroeconomic stability and income distribution dimension deteriorated sharply until 2007, reaching very low levels, slightly improved in the following two years and improved markedly after 2017. The dimension of investment and infrastructures recorded a mild positive trend until 2010, receded in the following year, in connection with the Portuguese economic and financial assistance program, and recorded a slight downward path since 2014. Finally, the education and innovation dimension shows the worst performance among all dimensions until the mid 2000s but increased markedly up to 2008, remaining stable afterwards.

Relatively to the other countries presented, Portugal is far from the levels attained by Sweden and, despite the strong recovery after 2017, the improvement was not as steady as the one observed in Austria or the Czech Republic in the period analyzed. Portugal ranks in the lower tier in the EU but records the greatest progress among this reference group, as compared to 2007. Developments in dimensions "Macroeconomic stability and income distribution" and "Institutions and markets" support these improvements.
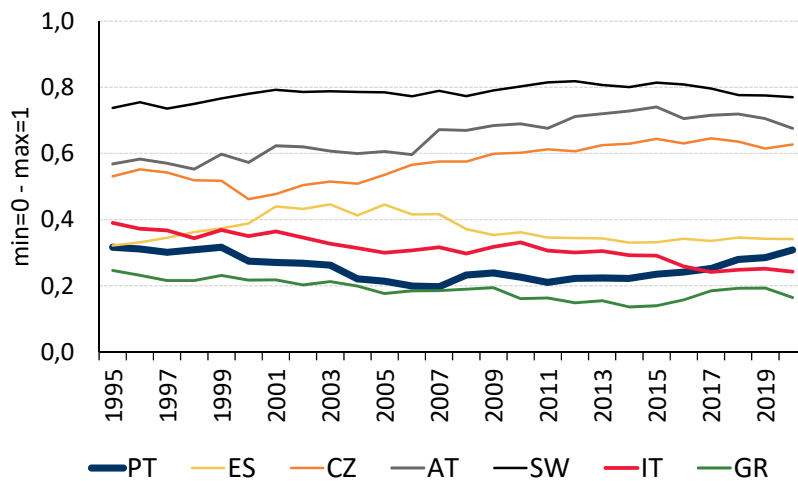


FIGURE 1: Dynamics of the composite competitiveness indicator in Portugal and selected EU countries

# The competitiveness of the Portuguese economy: A view from a composite indicator

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**Abstract**

This article analyses the competitive conditions in Portugal using a new composite competitiveness indicator (ICC) that combines annual cross-country aggregated data on a set of competitiveness-related variables. The indicator uses a simple metric to measure the gap of each country comparing to the best performer on each competitiveness-related variable considered, within the set of European Union Member-States. The ICC provides a comprehensive view of the relative evolution of the Portuguese competitiveness vis-à-vis the other EU countries over the period of 1995-2020. Despite significant improvements in the last years, the levels of the indicator are similar to those observed in 1995. Portugal ranks in 21st position in the EU but records the greatest progress among this reference group, as compared to 2007. The indicator is not affected by the disturbances caused by the COVID-19 pandemic on economic data and the Portuguese competitive conditions do not seem to have been altered by this shock. (JEL: O47, O52)

## 1. Introduction

Economic policy debate systematically revolves around the need to act on the determinants of long-term growth. However, these determinants are numerous and interact in a complex way. Aspects like the quantity and quality of inputs, especially human capital and innovation, the functioning of markets and the quality of institutions are typically part of this list. In addition, elements related to social cohesion and distribution of income have also been highlighted as important drivers of long-term economic growth.

In Portugal, the discussion on long-term economic growth and structural reform is also present and it is exacerbated by the relatively disappointing performance of the economy over the last decades. In this vein, Banco de Portugal (2019) analyses the real convergence process in the European Union (EU) and the relative performance of Portugal's GDP per capita over the period 1960-2018. The analysis shows that the process of real convergence of the Portuguese economy has halted in the last 25 years. In addition, Amador and Santos (2020) estimates a common dynamic stochastic production frontier for the EU countries in the period 1990–2017 and disentangles the total contribution of inputs' accumulation and total factor productivity to GDP growth. Results reflect a modest performance of the Portuguese economy along the last decades, particularly in terms of the contribution of efficiency developments. Nonetheless, the Portuguese economy has undergone several transformations and adopted a comprehensive set of structural reforms, whose impact is probably still not fully visible. This situation makes it key to monitor competitiveness conditions in the Portuguese economy relatively to other European countries, and identify dimensions where there is under performance.

The objective of this article is to discuss competitiveness developments in the Portuguese economy using a composite indicator. Our analysis focuses on Portugal but, given its relative nature, the indicator can be replicated and compared across all reference countries. This work should be taken as a contribution for the debate and there is ample room for improvements going forward. For example, as they become available, different sets of indicators may be incorporated and alternative weighting procedures may be adopted.

Competitiveness is a diffuse concept, and its quantification encompasses a very wide range of areas. Therefore, any attempt to measure it requires many indicators of different types. Such multidimensional problem poses significant challenges, notably in terms of aggregating information and communicating a straightforward message.

The classic way of assessing competitive conditions relies on scoreboards that compare levels of relevant indicators for several countries, but in recent years composite indicators became popular tools to assess multi-dimensional economic phenomena. A growing number of international organizations has been developing composite indicators on various economic domains, making them part of the policy debate at both national and international levels. Examples are the Global Competitiveness Index published by the World Economic Forum (WEF 2019), the Product Market Regulation index and the Employment Protection Legislation index, both published by the OECD (Vitale *et al.* 2020 and OECD 2013), as well as the Doing Business Report, published by the World Bank (World Bank 2020).

An interesting example of a competitiveness composite indicator is Huemer *et al.* (2013). This paper presents an index that captures institutional and price competitiveness dimensions, covering 36 countries from 1990 to 2009, arranged along three groups (16 EMU countries, 10 non-EMU EU countries and 10 other OECD countries). It concludes that the individual components of institutional competitiveness have developed heterogeneously among EMU Member-States and that an uneven integration within the EU Single Market may play a role in this result. Our article differs

from Huemer *et al.* (2013) in terms of the scope of indicators, the reference group of countries and in the method used to test the robustness of the weighting procedure. In the latter dimension, we randomize weights of dimensions and individual indicators while Huemer *et al.* (2013) uses a factor decomposition analysis to show that the baseline assumption of uniform weights is justified.

A very important aspect to keep in mind is that countries undergo structural reforms simultaneously. Therefore, it is necessary to define a measure that compares countries' relative performance, for example in terms of distances to the best performer in a reference group. Without such benchmark, i.e, if results just reflect the path of the underlying indicators in a specific country, conclusions are misleading. Improvements in an indicator in a given country should only translate into higher competitiveness if they are stronger than those recorded by the other countries in the benchmark group. A composite indicator of competitiveness also requires that related indicators are converted into a common metric, strictly comparable across countries. To address these aspects we normalize the data by setting the distance to the best performer, as a percentage of the interval between best and worst performers. This empirical strategy is quite useful in the context of the COVID-19 pandemic. Although most macroeconomic variables faced sharp swings due to the pandemic, cross country comparisons in terms of distance to the best performer remain valid.

Another relevant aspect concerns the weighting of individual indicators in order to produce a single competitiveness indicator. Results may differ according to the choice of weights. To address this caveat, we randomize weights of basic indicators and recalculate the composite indicator for each draw. The interquartile range of the resulting distribution of values, in each moment, may be interpreted as a robustness interval around a baseline formulation with uniform weights.

Taking all the above concerns into consideration, data availability limitations inevitably arise. Identifying indicators with a long time span that are also strictly comparable for all reference countries is challenging. To fulfil these requisites we do not consider some potentially interesting dimensions and/or indicators of competitiveness.

Overall, composite competitiveness indicators (like the one used here) present both advantages and shortcomings. Advantages concern the comprehensiveness of dimensions covered, as well as their relative nature and temporal consistency. Shortcomings relate to restrictions on the set of eligible indicators and impossibility of identifying the most suitable set of weights.

The article is organized as follows. In the next section we describe the structure of the composite competitiveness indicator (ICC) and discuss the methodological options underlying its construction. We briefly present the selected competitiveness dimensions, the statistical requirements for selecting the indicators in each dimension, and the corresponding statistical sources. Next, we present the metric used to set the distance to the best performer and the weights used to aggregate information into a single indicator. Weighting is an important feature, thus we also discuss the procedure adopted to assess robustness of results under different options. Section 3 presents the results and is organized along three blocks. Firstly, we present the path of the ICC, its main dimensions and their contribution to yearly changes. Secondly, we compare results with

those for other EU countries, which set the benchmark regarding best performance in each variable. Thirdly, we compare the path of the ICC with that of relative labour productivity and relative GDP per capita, thus establishing an association with these two key outcome variables. Section 4 presents some final remarks.

## 2. Methodology

The competitiveness indicator presented in this article follows the practices recommended for the construction of composite indicators, as discussed in OECD and European Commission (2008). Those guidelines make it possible to maximize relevance, transparency and robustness of results. The quality of a composite indicator depends on the set of variables chosen, which determines its ability to capture a multidimensional phenomenon, and on the methodological procedures. The options underlying its calculation are also decisive for the outcome as they determine the degree of transparency and robustness of the indicator itself. This section briefly presents the rationale underlying the choice of the competitiveness dimensions that are part of the ICC, as well as operational aspects, in particular those concerning data normalization, weighting and aggregation.

### 2.1. Competitiveness dimensions

As thoughtfully pointed out in OECD and European Commission (2008), "*what is badly defined is likely to be badly measured*". Therefore, the first step towards the creation of an indicator that assesses a country's competitiveness is to clarify the definition and discuss differences relatively to other indicators.

Competitiveness is a diffuse and complex concept, with no consensual definition. A possibility is to define it in relative terms (with respect to competitors) and associated with a country's ability to use and combine available resources and skills to produce and sell goods in international markets, to generate wealth in a sustainable way and ensure high living standards for its citizens. In contrast, productivity is a measure of economic efficiency. It measures the way resources of an economy (e.g., labour, intermediate products, capital) are converted into final products by firms, industries and the economy as a whole (CPP 2019).

Competitiveness and productivity are often used interchangeably. For example, Porter (1990) states that the only meaningful concept of competitiveness in a country is national productivity. Differently, the Global Competitiveness Report by the World Economic Forum defines competitiveness as the set of institutions, policies and factors that determine the level of productivity of a country. In this perspective productivity comes out as an outcome variable of upstream competitiveness conditions. Finally, Atkinson (2013) states that productivity growth enables competitiveness, especially if it is concentrated in tradable sectors.

To construct our competitiveness indicator we choose four broad dimensions, namely: i) Macroeconomic stability and income distribution; ii) Education and innovation; iii) Investment and infrastructure and iv) Institutions and markets. Each
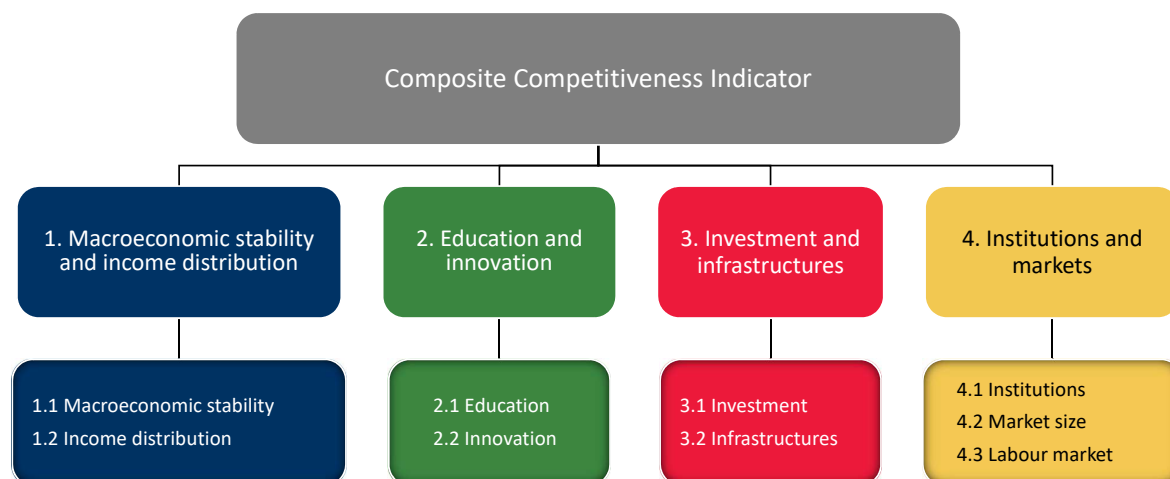
FIGURE 1: Structure of the composite competitiveness indicator

of these dimensions is subdivided into pillars that represent the topics of interest. Accordingly, the composite indicator considers four dimensions broken down along a total of nine pillars, as presented in Figure 1.

Starting from this structure, we select a set of relevant indicators for each pillar considered. Two basic criteria were established for the selection of the indicators: i) international comparability, in particular being available for the set of EU Member-States, and ii) availability of data for the period 1995-2020. This long time horizon is warranted to identify structural transformations that impact competitiveness conditions. Basing on these criteria, 25 indicators were selected and grouped into their correspondent pillar/dimension. The list of indicators is presented in Table 1.

For some indicators there is no information for all EU countries, mostly in the early years of the sample. Although the methodology accommodates this situation, since it only relies on the identification of the best and worst performances in each indicator at each moment of time, we used basic imputation techniques to estimate this small set of missing values and obtained a balanced information panel for the time horizon under analysis. Nevertheless, our data requirements made it unfeasible to use several indicators that, a priori, would be taken as relevant for the composite competitiveness indicator. Appendix A presents a list of indicators that were considered, but not included in the analysis.

### 2.1.1. Macroeconomic stability

It is widely acknowledged that the prevailing macroeconomic conditions strongly influence the decisions of economic agents, thus shaping long-term structural conditions. For example, whenever national savings are lower than investment decisions, this leads to current account imbalances and external financing needs. The persistence of these imbalances is associated to firms', households' and public indebtedness, it undermines their future financing capacity and may even lead to a sudden stop in external financing and a current account crisis. Subsequent effects, such as contractionary fiscal policies and higher market financing interest rates penalize

| | Dimension | | Pillar | | Indicator | Source |
|---|---|---|---|---|---|---|
| 1 | Macro stability & income distribution | 1.1 | Macro stability | 1.1.1 | Net savings (% GDP) | Eurostat |
| | | | | 1.1.2 | Government balance (% GDP) | Eurostat |
| | | | | 1.1.3 | Public + private debt (% GDP) | Eurostat |
| | | | | 1.1.4 | Unemployment rate | Eurostat |
| | | 1.2 | Income distribution | 1.2.1 | Last decile income (% total) | WID |
| | | | | 1.2.2 | Gini coefficient | WID |
| 2 | Education & innovation | 2.1 | Education | 2.1.1 | Average number of schooling years | World Bank |
| | | | | 2.1.2 | Active pop with tertiary educ (% active pop) | ILO |
| | | 2.2 | Innovation | 2.2.1 | R&D expenditure (% GDP) | Eurostat |
| | | | | 2.2.2 | Employees on R&D (FTE, % employment) | Eurostat |
| 3 | Investment & quality of infrastructure | 3.1 | Investment | 3.1.1 | Adjusted GFCF (% GDP) | Eurostat |
| | | | | 3.1.2 | Capital per worker | EC-AMECO |
| | | 3.2 | Quality of infrastructure | 3.2.1 | Density rail | World Bank |
| | | | | 3.2.2 | Density roads | World Bank |
| | | | | 3.2.3 | Nb internet users (% pop.) | World Bank |
| | | | | 3.2.4 | Energy dependence ratio | Eurostat |
| 4 | Institutions & markets | 4.1 | Quality of institutions | 4.1.1 | Government efficiency | World Bank |
| | | | | 4.1.2 | Quality of regulation | World Bank |
| | | | | 4.1.3 | Rule of law | World Bank |
| | | | | 4.1.4 | Control of corruption | World Bank |
| | | | | 4.1.5 | Liberty of speech and responsibility | World Bank |
| | | | | 4.1.6 | Political liberty and absence of violence | World Bank |
| | | 4.2 | Market dimension | 4.2.1 | Degree of openness | Eurostat |
| | | 4.3 | Labour market | 4.3.1 | Long-term unemployment rate | Eurostat |
| | | | | 4.3.2 | Age dependency ratio | World Bank |

TABLE 1. Sub-indicators of the composite competitiveness indicator

Note: WID stands for "World Inequality Database".

investment decisions, thus hindering capital accumulation and future economic growth. In short, countries with no macroeconomic imbalances are more competitive as they offer an investment-friendly environment and reinforce confidence of economic agents.

Two additional points are worth making. Firstly, although the unemployment rate is mainly an indicator of the cyclical position of the economy, it also signals the magnitude of macroeconomic imbalances. In addition, it is widely acknowledged that unemployment is a major source of poverty and inequality, thus affecting social capital and long-term economic growth. Therefore, we take this indicator aboard in this pillar. Nevertheless, the explanation above makes it clear that the unemployment rate could also be part of the income distribution pillar. The fact that this variable overlaps macroeconomic stability and income distribution pillars is a strong reason to take them both under the same competitiveness dimension. Secondly, price stability, defined in the euro area as an inflation rate of 2 per cent over the medium term, is also an important indicator of macroeconomic stability. Although inflation recently became a worldwide concern, it has been kept at very low levels during the past decades, notably in the euro area. Therefore, we do not consider this indicator in the current version of the ICC. Even so, it should be pointed out that inflation differentials among countries that share the same currency translate directly into changes in price competitiveness, while for other

countries exchange rate depreciations may compensate the impact of higher inflation. In fact, in the period 1995-2020, some non euro area EU countries recorded relatively high inflation rates.

Overall, the set of indicators selected to monitor this pillar are: i) net savings as percentage of GDP; ii) fiscal balance as a percentage of GDP; iii) public and private debt as percentage of GDP and the unemployment rate.

## 2.1.2. Income distribution

Inequality in income distribution became an important part of economic debate and several international organizations put this topic in parallel with other variables used to assess competitiveness. Inequality in income distribution is a reflection of many factors, including unemployment, underemployment and precariousness, and it represents a major obstacle to economic growth. Rising inequality weakens competitiveness conditions because it limits access to health and education, and greatly increases the risk of social instability. The indicators selected to monitor this pillar are: i) income share held by the highest 10 per cent earners as a percentage of total pre-tax national income and ii) the Gini coefficient.

## 2.1.3. Education

There is a wide agreement that workers' education and skills are one of the main drivers of long-term productivity and GDP growth (Criscuolo *et al.* 2021). Skilled workers are more adaptable to technological changes and better equipped to cope with shocks by switching to new activities. This is especially important in a context where overall technological progress, particularly digitalization, allow for the international trade of services, thus introducing competition in many segments of the labour market. In addition, digitalization has been accelerating the automation of routine tasks, leading to a greater substitution away from labour.

Empirical literature on the positive impact of education on productivity and growth is numerous. One important study that covers several countries is Black and Lynch (1996) and examples of research applied to the Portuguese case are Gouveia *et al.* (2019) and Fernandes (2019). The indicators selected to monitor the evolution in this pillar are: i) average number of years of schooling and ii) working age population with tertiary education as a percentage of total working age population. It is important to recall that these indicators do not capture aspects related to the quality of the education system. As it is often the case, we measure formal qualification levels and not existing skills.

## 2.1.4. Innovation

Innovation and R&D are critical competitiveness levers. Innovation enables the introduction of new or improved products, services or production processes within firms (e.g. Jorgenson *et al.* 2008 and Balasubramanian and Sivadasan 2011). Moreover, innovation has positive externalities, favouring knowledge transfer and technological upgrades among sectors and firms (e.g. Gersbach and Schmutzler 2003 and Bloom

*et al.* 2013). In the Portuguese case, according to Fernandes (2019), higher R&D personnel leads to labour productivity growth and has a significant effect on total factor productivity. The indicators selected to monitor the evolution in this pillar are: i) R&D expenditure as a percentage of GDP and ii) R&D personnel as a percentage of employment. As mentioned above for the case of education, these indicators do not capture the actual results of the innovation process.

## 2.1.5. Investment

The accumulation of productive capital is an important driver of competitiveness. It allows for the incorporation of new technologies into the production process and the expansion of the productive capacity of firms. Higher capital per worker (capital deepening) typically mirrors the adoption of new technologies. The literature on the relationship between investment and growth is also vast. Examples of such studies are Dougherty and Jorgenson (1997) and Jorgenson *et al.* (2008), which conclude that, for a wide range of countries, investment and capital accumulation are the main sources of growth. Although there are different strands of research and diverse results, it is often referred that some types of investment are relatively more productive than others. For example, investments in buildings and structures are arguably relatively less productive than those associated to new technologies (i.e. automation, intellectual property, R&D or ICT). These investments foster efficiency and innovation, as discussed in Stundziene and Saboniene (2019) and Hall *et al.* (2010).

Therefore, to proxy the quality of investments, one indicator selected for this pillar is the adjusted gross fixed capital formation (GFCF), which excludes investment in construction and transport material. The indicators selected to monitor the evolution in this pillar are: i) adjusted GFCF as a percentage of GDP and ii) capital per worker.

## 2.1.6. Infrastructures

The quality of infrastructures, for example in transports systems, energy and telecommunications, is a key element to foster the competitiveness of firms. Transport costs shape economic activity and international trade, while affecting the mobility of workers. More broadly, according to Munnell (1992) and Esfahani and Ramirez (2003), public investment in infrastructure has a positive effect on economic growth. The indicators selected to monitor the evolution in this pillar are: i) railway density per $Km^2$; motorway density per $Km^2$; iii) energy dependence, defined as net imports as a percentage of total energy consumption, and iv) number of individuals using the internet as a percentage of total population.

As pointed out in other pillars, the quality of the services listed and their cost are not taken into account. In addition, indicators on port and airport networks should be considered, but they did not meet the requirements defined in terms of comparability and period for analysis. Moreover, given the presence of non-coastal countries in the benchmark group, the use of port indicators would distort results.

## 2.1.7. Institutions

The quality of institutions is another important dimension of competitiveness. This pillar incorporates aspects typically seen as prerequisites for investment and the efficient functioning of markets. The literature that links institutions and economic growth is again large. A thoughtful historical perspective is given by North (1989). For the Portuguese economy, Arnold and Barbosa (2015) found evidence of a significant relationship between the total factor productivity of firms and a set of policy variables. The authors conclude that more administrative requirements to open a business, a broader coverage of collective bargaining agreements, greater time requirements for compliance with tax obligations and a higher number of processes needed to enforce a contract are associated with lower productivity.

There is a comparatively larger number of indicators in this pillar because the nature of the underlying phenomenon is diverse. The type of indicators used is also subject to criticism because it is based on perceptions and not data on observed outcomes. The Worldwide Governance Indicators published by the World Bank reflect perceptions on the ability of the government to formulate and implement sound policies and regulations, as well as the credibility of its commitment to such policies. Moreover, we take aboard perceptions on the quality of the civil service and its degree of independence from political pressures, in particular the quality of contract enforcement, property rights, the police and courts, as well as the likelihood of crime and violence. Finally, we consider perceptions of the extent to which citizens are able to participate in the selection of their government, as well as freedom of expression, freedom of association, and a free media. The indicators selected to monitor the evolution in this pillar are: i) government effectiveness; ii) regulatory quality; iii) rule of law; iv) control of corruption, v) voice and accountability and vi) political stability and absence of violence/terrorism.

## 2.1.8. Market size

This pillar takes account of the dimension of the market available for firms in a country. Economies that are more integrated in the global markets through international trade of goods and services have a larger pool of potential clients. In addition, these firms are subject to stronger competition, which tends to bring about a positive impact on competitiveness. The single indicator selected to monitor the evolution in this pillar is the degree of openness, computed as the sum of export and import flows as a percentage of GDP.

## 2.1.9. Labour market

Labour market efficiency is usually considered an important driver of aggregate productivity and competitiveness, in the sense that it should promote an efficient allocation of resources across sectors and firms. According to Bräuninger and Pannenberg (2002), there is empirical evidence supporting the thesis that an increase in unemployment reduces long-term productivity. Taking a different angle, Shekhar and Ebeke (2016) concluded that the ageing of the population reduces labour productivity

growth, mainly due to its negative impact on total factor productivity. The indicators selected to monitor the evolution in this pillar are: i) long-term unemployment rate and ii) age dependency ratio (share of non-working age population relative to working age population).

As already pointed out, some indicators could be used in different pillars. It is not strange that such overlap exists because the economic system is intrinsically integrated. For example, the long-term unemployment rate is taken as part of the labour market pillar, but it also relates with macroeconomic stability, income distribution and education. In the latter perspective, the lower the education level of individuals, the narrower the range of positions they can successfully apply to. Conversely, long unemployment spells decrease the likelihood of re-entering the labour market because individuals depreciate their skills.

## 2.2. *Normalization of indicators*

Combining a broad set of competitiveness indicators into a simple and intuitive index requires the prior normalization of the data in order to establish a metric and to eliminate scale effects. Given the characteristics of the indicators and the ultimate goal of having a simple, transparent and easy to communicate composite competitiveness index, we chose the so-called "min-max" normalization method.

The "min-max" method normalizes all indicators $i$ into the same range, from 0 (least competitive) to 1 (most competitive), thus overcoming obstacles from combining indicators with different original scales. For each indicator series $x_i$, the "min-max" transformation takes the distance of country $p$ relative to the best performing country (among EU countries) in year $t$, normalizing this distance by the amplitude between the best and worst performers in the respective indicator in that year:

$$I_{ip}^t = 1 - \frac{max_p(x_i^t) - x_{ip}^t}{max_p(x_i^t) - min_p(x_i^t)} \tag{1}$$

Needless to say that the best performance ($max_p(x_i^t)$) or the worst performance ($min_p(x_i^t)$) may be associated to the highest or lowest values, depending on the indicator. The transformation enables comparisons over time but it is sensitive to the existence of outliers. To bypass this situation, equation 1 is adjusted in order not to consider the maximum and minimum of each indicator in each year, but its 90th and 10th percentiles instead, when ordered from the worst to the best performer[1]:

$$I_{ip}^t = 1 - \frac{P90_p(x_i^t) - x_{ip}^t}{P90_p(x_i^t) - P10_p(x_i^t)} \tag{2}$$

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1.   The use of the 10th and the 90th percentiles implies that for countries in the first and last decile, the indicator $I_{it}$ will take values equal to 0 or 1, respectively.

## 2.3. *Weights and aggregation*

After normalizing the set of selected competitiveness-related indicators to be included in the composite indicator, variables must be aggregated into a single index. For this purpose a simple weighting scheme is used, as presented in equation 3, where $D$ and $n$ stand for the number of dimensions and indicators inside each dimension, respectively. The choice of weights for each dimension $d$ and indicator $i$, as listed in Table 1, is always a discretionary decision with impact on results. The baseline option was to assign the same weight to each dimension and the same weight to each indicator within each dimension. That is useful to avoid overvaluation of dimensions with a larger number of indicators (such as in dimension "Institutions & markets").

$$ICC_p^t = \sum_{d=1}^{D} \frac{1}{D} \left[ \sum_{i=1}^{n} \frac{1}{n} \left( 1 - \frac{P90_p(x_i^t) - x_{ip}^t}{P90_p(x_i^t) - P10_p(x_i^t)} \right) \right] \tag{3}$$

There is no obvious solution to overcome the discretion in the weighting process. In order to achieve robustness of the results we carried out a complementary exercise where random weights (taken from a uniform distribution) are assigned to each dimension and, at the lower level, also randomly distributed to each of the indicators within each dimension. We recompute the ICC for 1000 random draws of the weights and obtain a distribution for the level of the indicator in each year. Next, we take the first and third quartiles of this distribution, in each year, and those numbers are used to define robustness bands for the indicator. Such robustness bands and the median of the distribution are presented in parallel with the baseline indicator. Appendix B presents the same robustness exercise for each dimension of the composite indicator.

## 3. Results

This section presents the path of the ICC for Portugal, its four dimensions and their contributions to yearly changes, comparisons with other countries, as well as comparisons with the path of relative productivity per worker, relative productivity per hour worked and relative GDP per capita.

## 3.1. *The composite competitiveness indicator*

Figure 2 presents the ICC in the period of 1995-2020, as well as the median, first and third quartiles of the distribution generated by the randomization of weights along the four dimensions and indicators inside each dimension. The ICC signals a modest path for competitiveness in the period under analysis. The indicator consistently stays close to or below 0.3 in a scale with a maximum of 1. The ICC presented a downward trajectory until 2007. In 2008 and 2009 the indicator slightly recovered but this was interrupted in the period 2010-2011. Finally, between 2014 and 2020 there was a steady recovery, placing the indicator at levels similar to those existing in 1995. It is worth highlighting

that results for 2020, which reflect the early impact of the COVID-19 pandemic, show a rise in the ICC, signalling that this shock may not have hurt the competitiveness of the Portuguese economy in its first year.
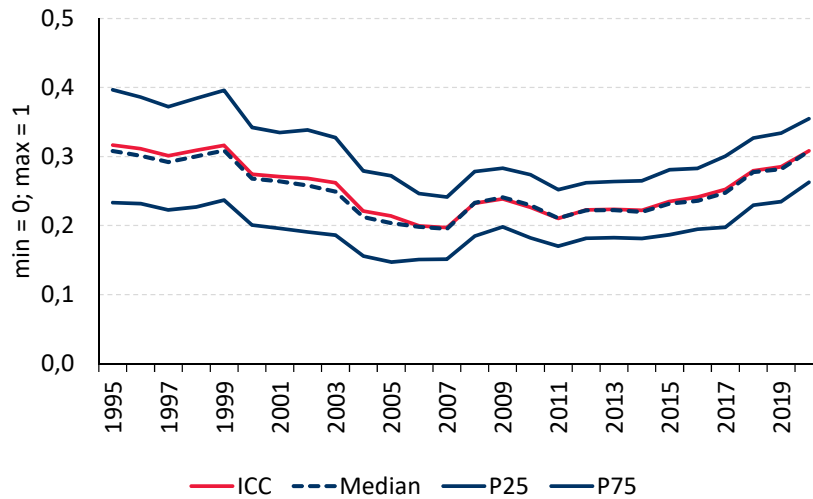


FIGURE 2: Composite competitiveness indicator

Note: The ICC is computed with uniform weights for each dimension and for each indicator inside each of them. The median, and the percentiles P25 and P75 are obtained from the distribution of the indicator that results from its calculation with 1000 random draws of weights, using a uniform distribution, both for its four dimensions dimensions and for the indicators that compose them.
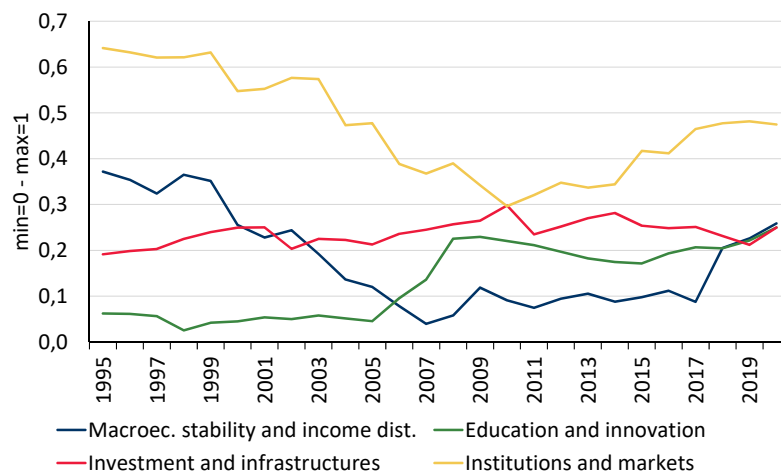


FIGURE 3: Dimensions of the composite competitiveness indicator

Figure 3 presents the path of the four dimensions of competitiveness that compose the ICC. Institutions and markets is the dimension with the highest level among the four considered. Despite the very strong decrease observed until 2010, there was a partial recovery up to 2020, placing the level of the indicator in this dimension slightly below 0.5. The levels observed for the other three dimensions in 2020 are quite similar and above 0.2. Nevertheless, their path taken since 1995 was quite different. The macroeconomic stability and income distribution dimension deteriorated sharply

until 2007, reaching very low levels, slightly improved in the following two years and improved markedly after 2017. The dimension of investment and infrastructures recorded a mild positive trend until 2010, receded in the following year, in connection with the Portuguese economic and financial assistance program, and recorded a slight downward path since 2014. Finally, the education and innovation dimension shows the worst performance among all dimensions until the mid 2000s but increased markedly up to 2008, remaining stable afterwards.

Figure 4 presents the contributions of each dimension to the yearly changes in the indicator. Since all dimensions have a similar weight, these contributions are just one fourth of the yearly change, as presented in Figure 3. Nevertheless, the graph makes it clear that large changes in the composite indicator in specific years are typically attributed to a dominant contribution from a single dimension. The improvement in "Education and innovation" in 2008 is attributable to improvements in R&D indicators and the improvement in "Macroeconomic stability and income distribution" in 2018 is attributable to an improvement in the fiscal balance.
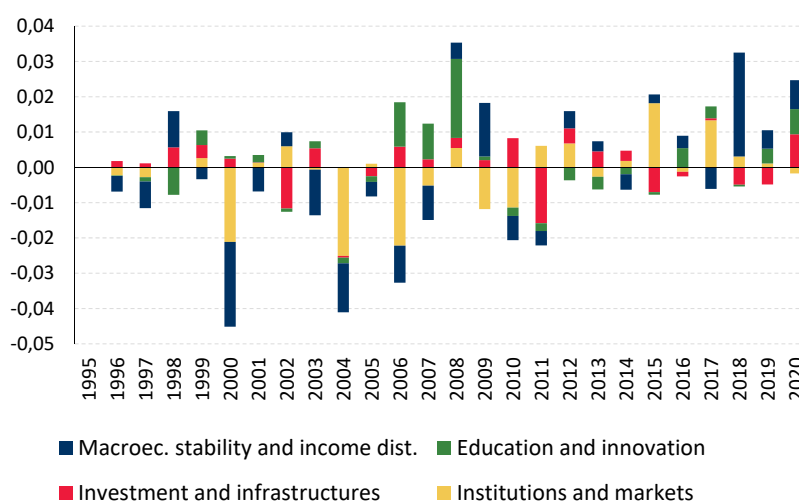


FIGURE 4: Contributions to changes in the composite competitiveness indicator

Figures 3 and 4 make the point that underlying competitiveness drivers have a quite different dynamics. In this context, the use of different weights for each one of them could affect the results and conclusions. However, the exercise associated with the recalculation of the ICC for a random set of weights, and the subsequent calculation of a robustness band, shows that the overall conclusions are not altered. As depicted in Figure 2, these bands are not very wide, the indicator stays always at low levels and its path is consistent with some improvements in the latest years. The four panels in Appendix B present the path of each dimension of the composite indicator, together with their respective robustness bands. In all cases the bands are quite narrow and the interpretations made above remain unaltered.

Figure 5 presents the values of the different pillars in each of the four dimensions of the composite indicator, as listed in Table 1, for the years 1995, 2007 and 2020. There was an improvement in all pillars from 2007 to 2020, except in "Investment"

and "Market dimension". Nevertheless, only "Institutions" achieved a score above 0.5 in 2020. Moreover, despite the substantial improvements in Portuguese qualifications in the last decades, "Education" has the lowest score among the entire set of pillars because other EU countries have also improved their educational outcomes. Conversely, "Innovation" has recorded sharp improvements and stands in 2020 as the second pillar with the highest score, below "Institutions" and close to "Labour market efficiency". "Income distribution" has also recorded strong improvements in the latest period.
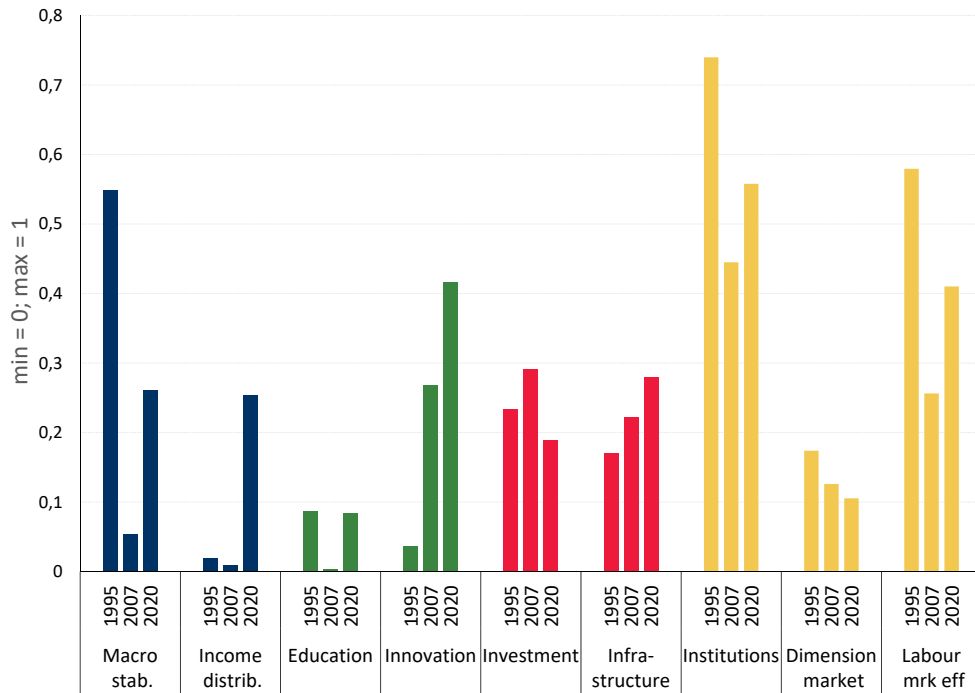


FIGURE 5: Pillars of the composite competitiveness indicator

## 3.2. *International comparison*

The composite competitiveness indicator presented above can be calculated in a similar way for other EU Member-States. Consequently, it is possible to make direct cross-country comparisons. This advantage derives both from the use of comparable data for all indicators, within the same time interval, and from the relative nature of the composite indicator, i.e., the fact that it is based on the distance relatively to the best performer within the reference group.

Figure 6 presents the level of the ICC for EU countries in the years 2007 and 2020. Sweden, the Netherlands and Denmark are the countries with highest values in 2020, reaching a level close to 0.8. Conversely, Greece, Italy and Croatia are the three countries with the lowest levels in the composite indicator in 2020. It should be noted that this ranking must take into account the absence of countries for which it was not possible to compute the indicator in these years due to lack of data. This was the case of Cyprus, Malta and Romania. Portugal ranks in the bottom tier (21st) but records the greatest progress among the reference group, as compared to 2007, the year immediately before the start of the economic and financial crisis. Poland and Ireland also record significant

progress from 2007 to 2020, while Finland, Denmark, France and Spain record the largest reductions.

Figure 7 shows the yearly path of the ICC for a selected group of EU countries that are either similarly sized or stand as important Portuguese trade partners. The figure shows great stability in the level of the ICC over the period considered. This is not a surprising result because competitiveness and its drivers are mostly structural variables, thus changing slowly over time. Within this set of countries, two exceptions to this broad stability are the Czech Republic and Austria, that have recorded sustained improvements in competitiveness.
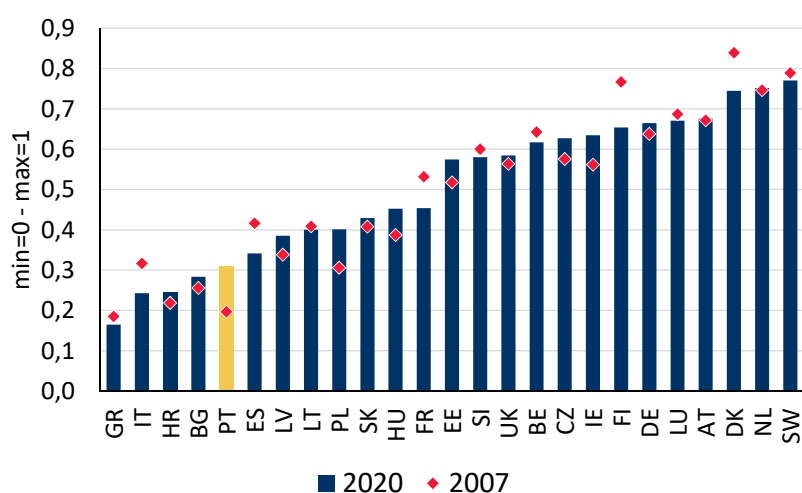


FIGURE 6: Composite competitiveness indicator in EU countries
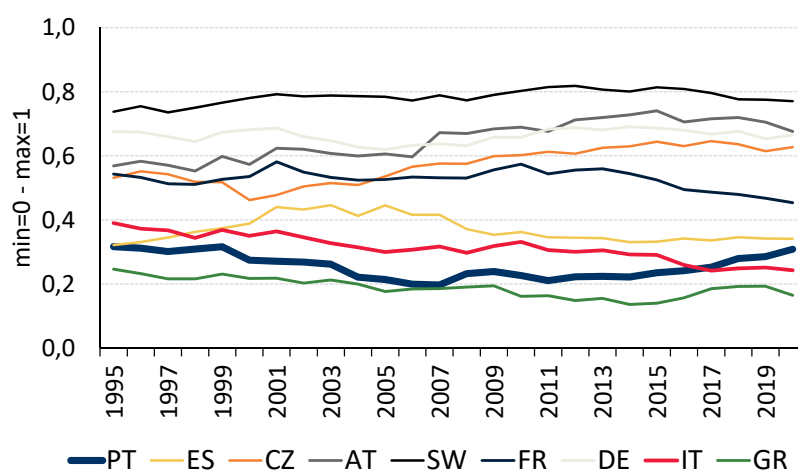


FIGURE 7: Dynamics of the composite competitiveness indicator in selected EU countries

## 3.3. Competitiveness, labour productivity and GDP per capita

In this subsection we compare the path of the ICC with that of three outcome variables: relative labour productivity per worker, relative labour productivity per hour worked

and relative GDP per capita. In order to have a meaningful comparison, those variables are transformed using the *"min-max"* method, i.e., defined in terms of deviations to the best performer in the reference group. One initial consideration to make relates to the nature of this comparison and its limitations. The economic system is complex and it is obvious that gains in competitiveness translate into higher productivity and GDP per capita, which influence back the path of the indicators used to assess competitiveness in the first place. One example is the impact of higher GDP levels on the denominator of several indicators used to assess competitiveness (e.g. Net savings, R&D expenditure, adjusted GFCF). This circularity makes us question the benefit of comparing the ICC with the above-mentioned outcome variables. In addition, there may be little benefit in assessing competitiveness conditions if the outcome variables are already observable. Nevertheless, there are clear advantages in the comparison between the ICC and the outcome variables. The ICC includes many variables with a structural nature, thus it is not affected by cyclical developments in the same way as GDP per capita or productivity. Therefore, deviations between the indicators may indirectly signal gaps of GDP and productivity from their potential. Moreover, it is possible to assess which dimensions of the ICC are more tightly associated with the path of the outcome variables.

Figure 8 compares the path of the ICC with the one of relative productivity per worker, relative productivity per hour worked and relative GDP per capita, taking an index based in 1995. The ICC and productivity per worker recorded a quite similar evolution until 2014. After that year, which corresponds to the end of the economic and financial assistance program in Portugal, the competitive conditions improved but relative labour productivity maintained a downward trend up to 2020. The comparison of the ICC with productivity per hour worked signals a decoupling starting at the beginning of the great economic and financial crisis in 2008. As for the comparison with the GDP per capita, again expressed in terms of distance to the best performer in the benchmark group, we also observe a decoupling after 2010 that continues up to 2020.

In this context, it is useful to compare the path of the ICC and relative productivity per worker in other EU countries. The results are presented in Appendix C and show quite different realities. The better performance of the ICC versus the relative labour productivity is also visible in Spain, the Czech Republic and Austria, and more mildly in Germany and the Netherlands. In all these cases the decoupling started earlier than in Portugal and it is associated to an underlying reduction in productivity. In this group, only in Austria and the Czech Republic the ICC shows an upward trajectory in this period.

It should be noted that the evolution of the index for the relative productivity in Portugal is quite negative and only comparable to that of Greece. This evolution results from a combination of relatively low productivity growth rates and a low starting value for productivity, which leads to a widening of the gap versus the best performing country.

Different explanations can be put forward for the sharp decoupling of the ICC versus the outcome variables in the most recent period in Portugal. One possibility is the underestimation of GDP growth in the latest years. This thesis can be supported by upward revisions in official Portuguese GDP growth rates in the latest years.
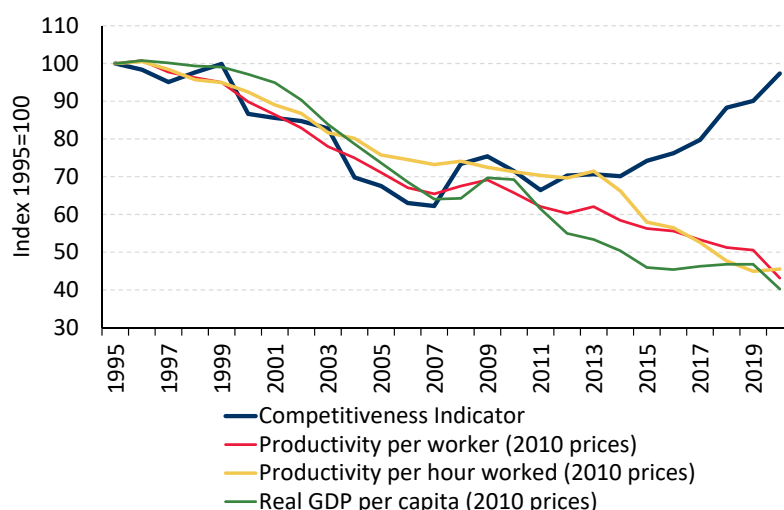
FIGURE 8: Composite competitiveness indicator, relative labour productivity and relative GDP per capita

Note: Labour productivity and GDP per capita, source Eurostat. Similarly to the ICC, relative labour productivity and relative GDP per capita are computed as deviations to the best performer as a percentage of the distance between the best and worst performers, also correcting for extreme values by using the percentiles 90 and 10.

However, this could hardly be the only explanation. Another explanation may be the incompleteness of the composite indicator in terms of dimensions or indicators to capture the full underlying competitive conditions of the economy. A third explanation is that aggregate labour productivity and GDP post cyclical fluctuations, while composite competitiveness indicators have a more structural nature. Therefore, the gap between the two series is reflecting a deviation of activity and productivity relatively to their true potential. However, the observed divergence for long periods of time in other countries reduces the likelihood of this explanation.

A final consideration relates to the possibility of using different outcome variables, which would presumably have a tighter connection with competitiveness developments. One possibility would be the market share of exports in world trade. However, this series raises problems in terms of controlling for the relative size of the countries and results would be seriously biased due to different import content in exports across countries, associated to uneven levels of integration in global value chains (GVCs). Considering the current account balance as an outcome variable is not a solution either. Beyond being difficult to assess the conditions under which a current account deficit (or surplus) is benign or malign, it relates to the net savings indicator in the macroeconomic stability and income distribution dimension, vividly reminding us of the above mentioned circularity of the exercise.

## 4. Final remarks

The analysis of the underlying competitive conditions across countries is an important and complex topic. The main difficulty lays on the definition of this concept. Beyond the

multiplicity of dimensions underlying competitiveness, there are difficulties in having relevant indicators that are both comparable between countries and available with a large time horizon. Additionally, it is necessary to aggregate the various dimensions of analysis into a synthetic indicator, which arises issues about weighting procedures.

Our work seeks to contribute to this debate, adopting specific solutions for the difficulties mentioned. Results obtained point to a modest performance of competitiveness in the Portuguese economy in the recent decades. The level of the indicator in 2020 is similar to that observed in 1995 and remains near 0.3 in a maximum score of 1. In terms of ranking within the set of EU countries the Portuguese economy is placed in the bottom group. Nevertheless, it is worth noting that in the latest years the performance has been positive. Developments in dimensions "Macroeconomic stability and income distribution" and "Institutions and markets" support these improvements. Results for 2020 are also encouraging, signalling that the COVID-19 pandemic may not have hurt Portuguese competitiveness in its initial year.

Our article offers a diagnosis procedure for competitiveness in the Portuguese economy that will hopefully enhance public discussion and improve decision-making. Similar analysis are also possible for other EU countries. Finally, given the complexity of the topic, it is important to underline that results are, even more than usually, open for debate. A full acknowledgment of the weaknesses and caveats of the exercise is the starting point for future work.

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# Appendix A: Alternative indicators

| Indicator | Source | 1st year |
|---|---|---|
| **Macroeconomic stability and income distribution** | | |
| Cyclically adjusted budget balance | AMECO | 2010 |
| Nominal unit labour costs | Eurostat | 1995 |
| Net international investment position % GDP | Eurostat | 1995 |
| **Income distribution** | | |
| Income quintile share ratio for disposable income | Eurostat EU-SILC | 2003 |
| Income quintile share ratio for gross market income | Eurostat EU-SILC | 2010 |
| Income quintile share ratio for net market income | Eurostat EU-SILC | 2010 |
| Income quintile share ratio for gross total disposable income | Eurostat EU-SILC | 2010 |
| **Education** | | |
| PISA scores | OECD | 2000 |
| High-skilled Population | Eurostat | 2004 |
| Adult participation in learning % of pop. 25 64 | Eurostat | 2004 |
| Pop +18 participation in educ. and training | Eurostat | 2004 |
| Employment by educational attainment level | Eurostat | 1998 |
| Employment +18 participation in educ. and training | Eurostat | 2004 |
| Employment by educ. attainment and socio-economic group | Eurostat | 2011 |
| **Investment** | | |
| FDI % GDP | Eurostat | 1995 |
| FDI Regulatory Restrictiveness Index | OECD | 1997 |
| Stock of loans for non-financial corporations - total | Eurostat | 1995 |
| **Infrastructure** | | |
| Air transport, freight | Eurostat | 1995 |
| Air transport Infrastructure | Eurostat | 2001 |
| Efficiency of air transport Services | WEF - Executive Survey | 2014 |
| Air connectivity index | International Air Assoc. | 2007 |
| Maritime transport | Eurostat | 1997 |
| Liner shipping connectivity Index | UNCTAD | 2004 |
| Efficiency of seaports | WEF - Executive survey | 2014 |
| Efficiency of train services | WEF - Executive survey | 2014 |
| Quality of roads | WEF | 2016 |
| **Goods and services market** | | |
| Doing Business indicators | World Bank | 2005 |
| Product Market Regulation | OECD | 1998 |
| Economic Complexity Index | Harvard Growth Lab | 1995 |
| Services Trade Restrictiveness Index | OECD | 2014 |
| Electricity prices for household consumers | Eurostat | 2007 |
| Electricity prices for non-household consumers | Eurostat | 2007 |
| Gas prices for non-household consumers | Eurostat | 2007 |
| **Financial market** | | |
| Financial Soundness Indicators | IMF | 2003 |
| Factors limiting the Production (Industry) - Financial | Eurostat | 2001 |
| Factors limiting the Business (Services) - Financial | Eurostat | 2001 |
| % of firms with access to finance as a major constraint | World Bank | 2005 |
| **Labour market** | | |
| % 20-34 neither in employment nor in education and training | Eurostat | 2006 |
| Labour market slack [15-74] | Eurostat | 2008 |
| Factors limiting the business (Services) - Labour | Eurostat | 2001 |
| Employment Protection Legislation | OECD | 1995 |

TABLE A.1. List of indicators considered but not selected

Note: Series not included because they start after 1995, or have many missing countries in initial years or their underlying interpretation is dubious.

# Appendix B: Robustness of the composite competitiveness indicator for different weights



(A) Macroeconomic stability and income distribution (B) Education and innovaton



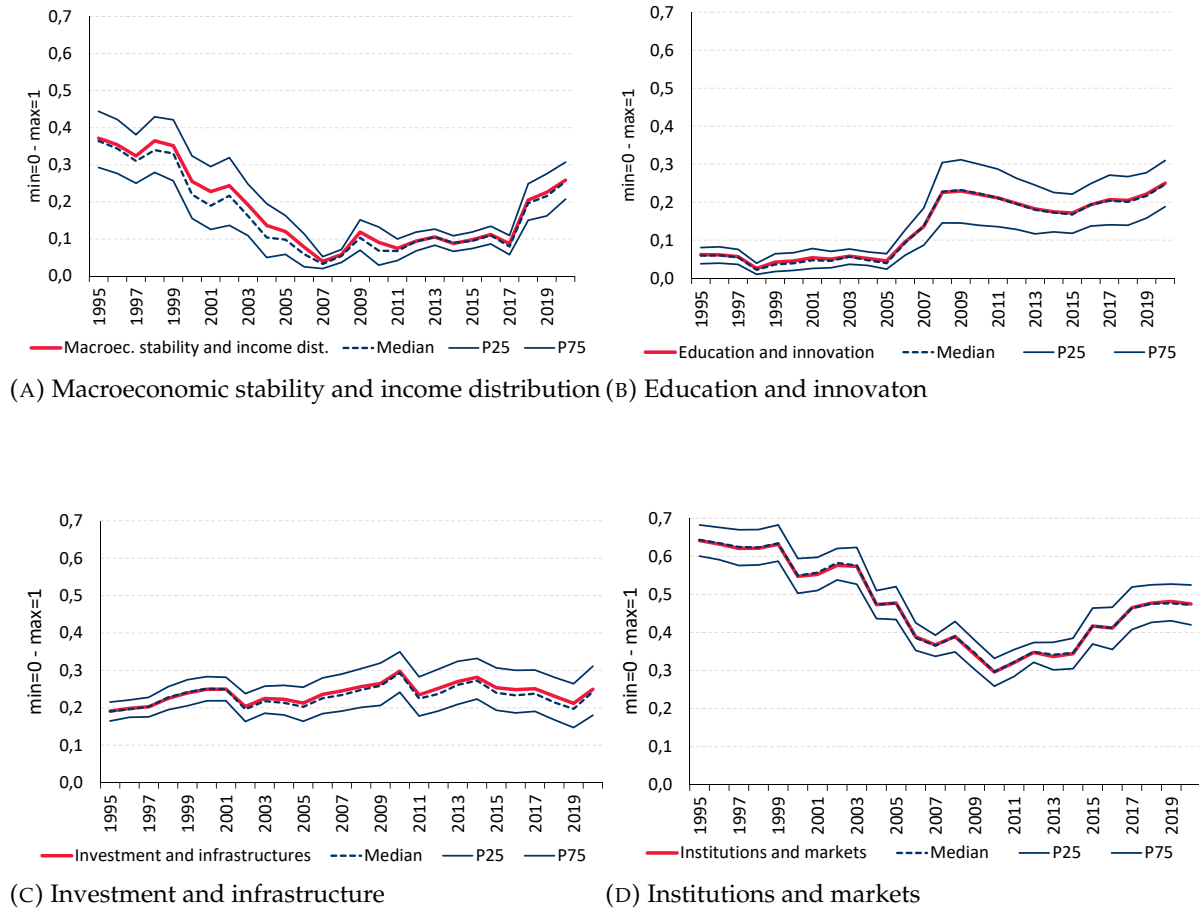(C) Investment and infrastructure         (D) Institutions and markets

FIGURE B.1: Dimensions of the composite competitiveness indicator - Robustness

Note: The ICC dimensions are computed with uniform weights for each indicator. The median, and the percentiles P25 and P75 are obtained from the distribution that results from their calculation with 1000 random draws of weights, using a uniform distribution.

# Appendix C: Composite competitiveness indicator and labour productivity in selected EU countries
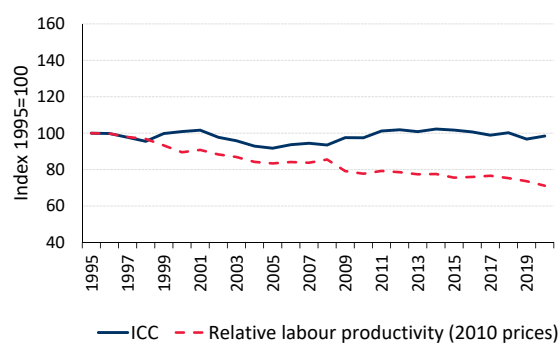


(A) Germany
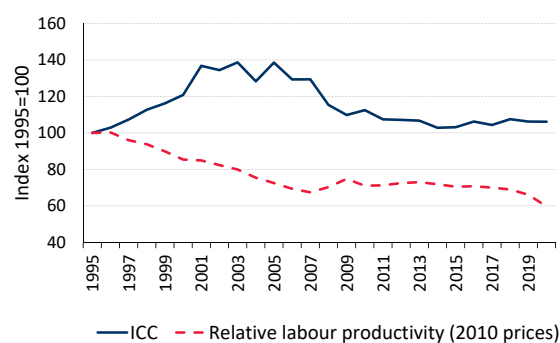
(B) Spain
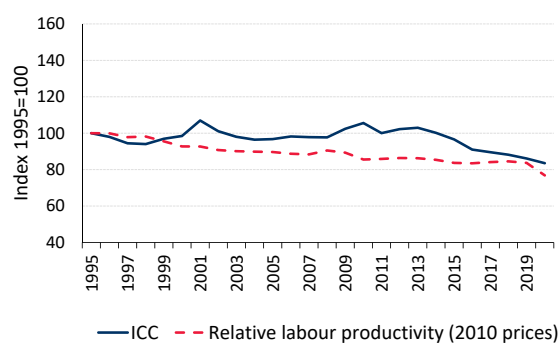
(C) France
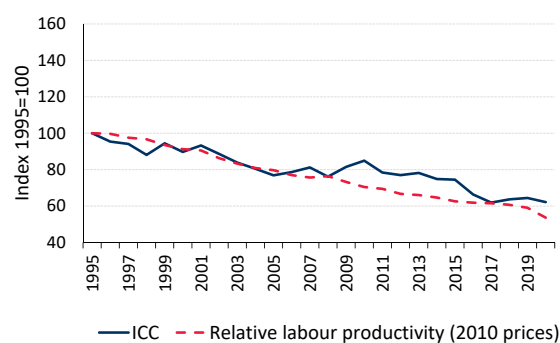
(D) Italy
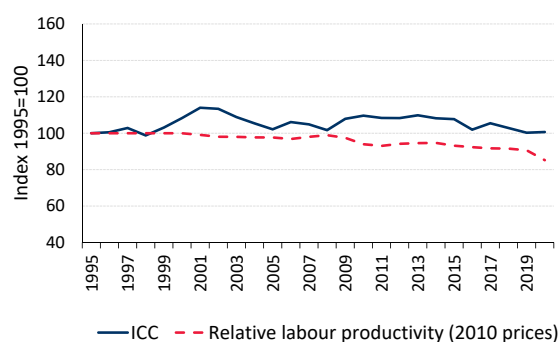
(E) Belgium
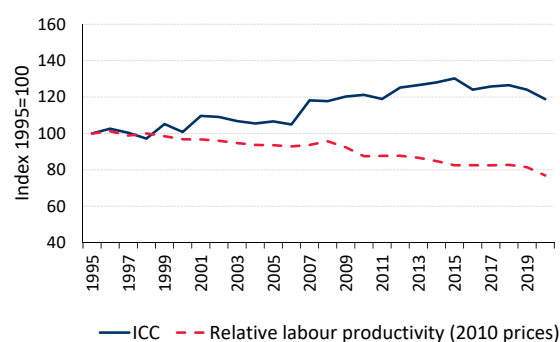
(F) Austria

FIGURE C.1: Composite competitiveness indicator and productivity - Selected EU countries
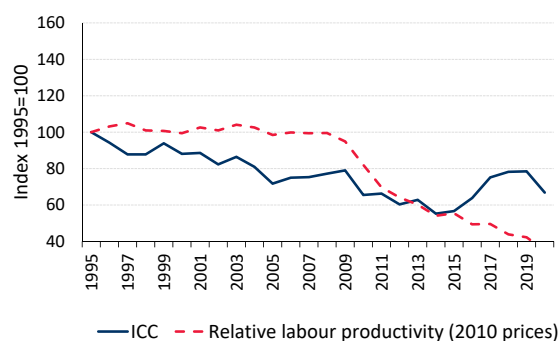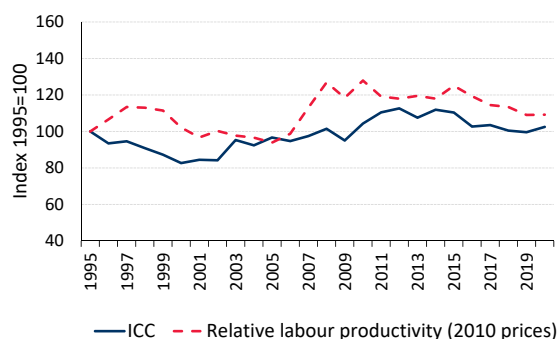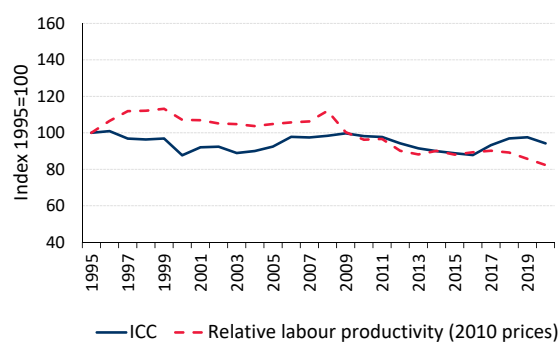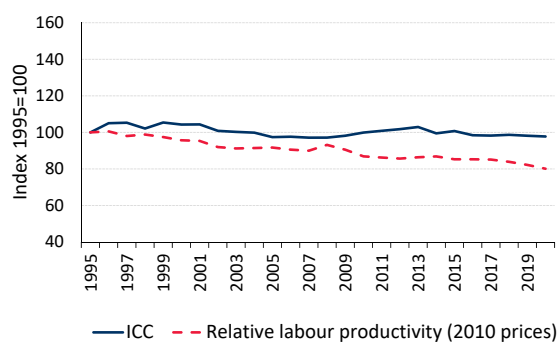
(G) Greece
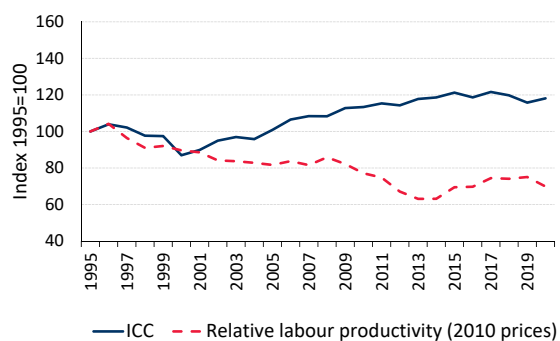


(H) Czech Republic
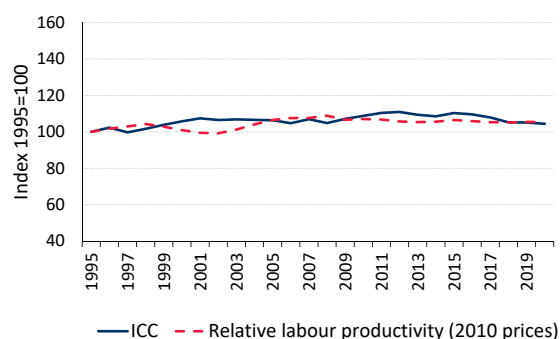


(I) Sweden



(J) Slovakia



(K) Slovenia



(L) Netherlands

FIGURE C.1: Composite competitiveness indicator and productivity - Selected EU countries

# Non-technical summary

April 2022

## An assessment of companies' competitiveness in Portugal and in some European countries

*Mário Lourenço, Cloé Magalhães, Fernando Martins, Manuel Coutinho Pereira and Hugo Reis*

This article presents a characterization of the competitiveness of companies in a set of Euro area countries, between 2008 and 2018, taking into account the results obtained from a composite Enterprise Competitiveness Indicator (ECI). This indicator is based on firm level financial information available in the iBACH database - microdata of the Bank for the Account of Companies Harmonized.

The use of firm level competitiveness indicators is of utmost importance in the current context of economic integration and marked technological progress. However, limitations in the availability of harmonised individual information have hampered the development of this type of indicators.

In order to fill this gap, the Working Group on Indicators of Competitiveness and Productivity of the Portuguese Economy (under the aegis of the Portuguese Statistical Council) recently developed the ECI.

The ECI reflects the positioning of companies in six dimensions of business competitiveness, namely, return, production costs, productivity, access to resources, risk and quality orientation. To this end, it makes use of a set of indicators for which there is empirical evidence on their ability to capture such dimensions of competitiveness (selected from among those which can be computed in the database used). The ECI is calculated at the company level, assuming a value between 0 (worst performer) and 1 (best performer). In this way, the ECI does not measure the absolute level of companies' performance, but rather their position between the two extreme values. Taking advantage of the microeconomic approach, several moments of the ECI distributions and of its dimensions were analysed.

Results indicate that Portuguese companies had, during the referred time span, levels of competitiveness systematically lower than those of the companies in the remaining countries analysed (Figure 1). Since 2013, however, Portuguese companies' competitiveness has recovered. Until 2016, this recovery resulted from the generalised reduction in the median value of the ECI (more significant in the remaining countries). The increase in the indicators associated with companies with the worst performance (which, for some ratios, recorded historically low performances after the 2008 financial crisis) contributed to this. From 2016 on, the median value of Portuguese companies

increased more than that of the remaining countries, suggesting an effective recovery in their competitiveness.
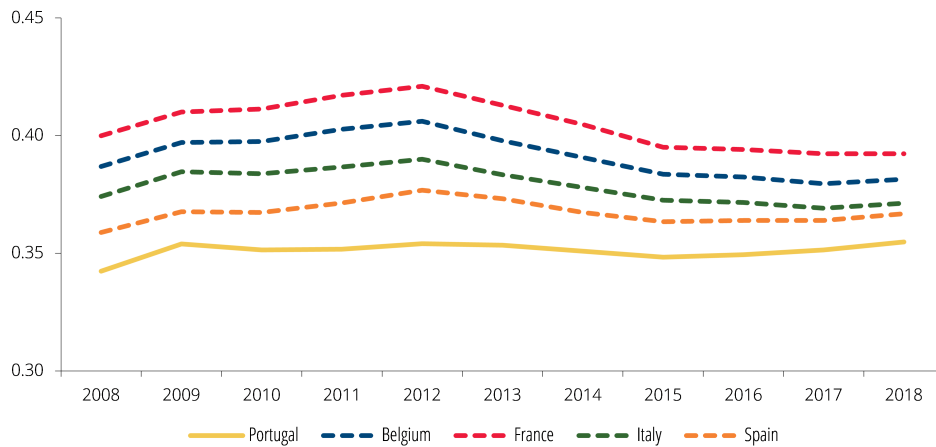


FIGURE 1: ECI | Median of the distributions by country

Note: The ECI is a relative indicator that measures, for each company, in each year, its position vis-à-vis companies with the worst and the best performances in their sector of activity, for each indicator, varying between 0 and 1.

The lower competitiveness of Portuguese companies reflects the worst performance in the dimensions associated with productivity and access to resources. The results also show that the relative positioning of Portuguese companies does not change when the analysis is carried out by sector of activity or company size. This evidence suggests that the competitive differential of Portuguese companies results mainly from intrinsic characteristics, rather than differences in the business composition (both by sector and size).

The relative position of the various countries also does not change when considering the companies with the worst or best performance. Portuguese companies present, in any case, lower values than those in the remaining analysed countries. Even so, Portugal's distance from the remaining countries is greater when considering the companies with the worst performance.

# An assessment of companies' competitiveness in Portugal and in some European countries

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April 2022

**Abstract**

This article analyses the competitiveness of companies from five Euro area countries (Portugal, Spain, France, Italy and Belgium) in the period 2008-2018, using a composite Enterprise Competitiveness Indicator (ECI) obtained from the individual financial statements. The ECI aggregates six relevant dimensions for the analysis of competitiveness: return, production costs, productivity, access to resources, risk and quality orientation. Based on the median value of the ECI, the analysis of this article suggests that, in this period, the competitiveness of Portuguese companies was always below the one observed in the remaining countries under analysis, despite the favorable evolution registered in recent years. The difference between the competitiveness of Portuguese companies and that of the remaining countries results, to a large extent, from their performance in terms of productivity and access to resources. In general terms, this behavior is registered across different size classes and sectors of activity. (JEL: D22, D40, L11)

## 1. Introduction

T his article presents an assessment of firms' competitiveness in Portugal and a number of Euro area countries between 2008 and 2018. The analysis is based on the performance of the Enterprise Competitiveness Indicator (ECI), a composite

indicator which aggregates six dimensions considered relevant for competitiveness analyses: return, production costs, productivity, access to resources, risk and quality orientation. The calculation of an indicator with these characteristics was only possible due to the recent availability of a harmonised microeconomic database for a group of Euro area countries, consisting of information obtained from firms' financial statements.

The production of the ECI resulted from a joint effort carried out within the framework of the Working Group on Indicators of Competitiveness and Productivity for the Portuguese Economy, created in 2018 by the Portuguese Statistical Council. In particular, the ECI was discussed and produced in the context of a more restricted group, with a specific mandate to explore microeconomic databases in order to build a composite indicator of competitiveness. Involved in this work were not only the authors of this article, but also economists from Statistics Portugal and the Office for Strategy and Studies of the Ministry of Economy and Digital Transition.[1]

It is not particularly challenging to justify the importance of analyzing competitiveness at the microeconomic level. The international context of increasing integration of economies, together with the strong pace of technological progress, namely with greater automation and digitalization of production processes, has posed renewed challenges to companies, making the environment in which they operate increasingly competitive.

Competitiveness is the concept that emerges in this framework. It is a multidimensional concept, which seeks to capture the way in which companies adjust to a constantly changing economic environment. It can be analysed at different levels. At the macroeconomic level, competitiveness mainly concerns the ability of economies to increase the wealth and level of well-being of their citizens in a sustained manner; at the microeconomic level, the competitiveness of companies can be understood as the current and future capacity of these to produce attractive goods and services, through quality and/or price, to compete domestically and internationally and to generate returns.

However, the debate on competitiveness tends to give greater prominence to the macroeconomic analysis. The lack of databases with harmonised microeconomic information covering a relatively wide range of countries certainly contributes to this fact. This information is essential because it reveals factors that, not being observable at the aggregate level, influence the global performance of economies. For example, it is now relatively consensual in the literature that many of the variables related to the concept of competitiveness, such as productivity, have distributions with significant asymmetry (Banco de Portugal 2021). These results, which are fundamental for a full assessment of competitiveness, can only be obtained with microeconomic information, having in mind that macroeconomic analysis typically place emphasis on measures of central tendency. Finally, it must be emphasised that companies, not countries, are the ones that produce, trade and, ultimately, face competition.

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1.  Specifically, for the production of the ECI contributed Ana Martins and Eva Pereira from the Office for Strategy and Studies of the Ministry of Economy and Digital Transition, and Rita Ponte from Statistics Portugal.

In this context, it seems essential to complement the typical toolkit of analysis of competitiveness with instruments that allow this assessment to be carried out at the microeconomic level. These instruments would make it possible to assess not only the average performance but also heterogeneity by analyzing other moments of the distribution. Unlike macroeconomic analysis, which seeks to measure dimensions such as sectoral structure, technological level or the existence and quality of infrastructures, at the company level the focus is on factors such as the quality of goods and services, profitability, access to finance, price competitiveness or the internal management practices (productivity, innovation, production costs, resource management and human capital).

This multidimensionality of competitiveness made the production of a synthetic indicator particularly challenging. The incorporation of some of these dimensions into a tangible metric required a selection of indicators that was anchored in the literature and conditional on the availability of information. These considerations were duly considered in the production of the ECI.

The article is structured as follows. Section 2 presents a number of arguments that support the importance of company-level competitiveness indicators. It also presents the database and methodology, with particular emphasis on the structure and calculation of the ECI. Section 3 presents the main results, while section 4 concludes.

## 2. Methodology

### 2.1. Framework

The discussion on how to define, measure and evaluate the concept of competitiveness has received important contributions from the empirical literature, namely from the areas of international trade and industrial organization. This literature has shown that aggregate economic performance, both at the sector and country level, strongly depends on company-level factors, such as the size of companies, organizational aspects, technological capacity, access to finance, as well as other conditions that companies face in the specific environment in which they operate.

In this article, we propose to analyse competitiveness on a microeconomic level, using a database with harmonised company-level information for some Euro area countries. We seek to underline the importance of this level of approach as a complement to the usual macroeconomic analyses, suggesting that indicators at the company level can be added to the usual macroeconomic tools for assessing competitiveness. This is the case with the ECI that is used in this article. This would make it possible to broaden the scope of approaches to competitiveness carried out with microeconomic data, currently used almost exclusively for the production of research papers, aiming at their more systematic use in the formulation of economic policies. Recognition of the importance of this level of analysis should also be a catalyst for the production and wider dissemination of harmonised microeconomic databases in this field.

Assessing country competitiveness with microeconomic data inevitably requires some degree of aggregation. However, in doing so, and in order to exploit in full the

richness of the available information, we should not only focus on measures of central tendency, such as the mean or median, but analyse the whole distribution. Empirical evidence based on microeconomic information for Portugal (Banco de Portugal 2021), but also for the United States (Bernard *et al.* 2012) and the European Union (Mayer and Ottaviano 2007), has shown that, contrary to the what it is often assumed, many relevant indicators for measuring competitiveness, such as productivity, do not typically follow symmetrical distributions. In fact, performance indicators calculated with microeconomic data are not characterised by the concentration of observations around a central average value, but by large company heterogeneity, with a very high number of companies with below-average performance and a smaller number of high-performing companies. This result translates into distributions with strong asymmetry. In particular, in the case of the ECI, it is possible to assess in full its distribution, as well as of all its dimensions and variables, including not only the central and non-central tendency, but also dispersion, asymmetry and kurtosis. Additionally, the longitudinal nature of the database allows the evaluation to be both cross-sectional and longitudinal.

## 2.2. *Methodology description*

The composite indicator for enterprise competitiveness proposed in this work follows the approach initiated by Buckley *et al.* (1988) and found in later works (e.g. Laureti and Viviani 2011), according to which the competitiveness of companies is a multidimensional phenomenon, which reflects both factors intrinsic to the company and the ability of companies to compete in national and international markets, generate returns for their stakeholders and sustain the competitive potential in the future.

The base indicators included in the ECI were selected among those available in the database and for which there is empirical evidence on their ability to measure or explain business competitiveness (Lourenço *et al.* 2022). These were aggregated into six dimensions of firm-level competitiveness: return, production costs, productivity, access to resources, risk and quality orientation. As the database contains individual accounting information, some aspects of firm competitiveness are insufficiently covered, such as international trade, the quality of management or the characteristics of human capital, which could be improved in the future by gathering information from other complementary databases.

## 2.3. *Database*

The ECI was obtained through iBACH - microdata of the Bank for the Account of Companies Harmonized, a database developed under the aegis of the European Committee of Central Balance Sheet Data Offices (ECCBSO[2]) that includes harmonised

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[2]. ECCBSO is a consultive body that gathers analysts from the Central Balance Sheet Data Offices of National Central Banks (or associated entities) from 28 European countries and the European Central Bank (ECB). The BACH (Bank for the Accounts of Companies Harmonized) database provides aggregated economic and financial information on non-financial companies in 12 European countries. This information follows a harmonised financial statement model, allowing the establishment of comparable data from

individual information on non-financial corporations[3] from six European countries: Belgium, Spain, France, Italy, Portugal and Slovakia. Despite the small number of countries included in iBACH, access to individual observations has the advantage of allowing greater flexibility in the sample selection and in the calculation of indicators based on the firms' relative performance.

The database used in this study corresponds to the March 2021 version. Some exclusion criteria were defined to ensure the comparability of the samples across countries. Observations relating to Slovakia were excluded as the number of employees is unavailable until 2018, and therefore is not possible to calculate some of the selected indicators. The selection criteria applied on the legal form, sector of economic activity, state of activity, type of data and number of employees intend to harmonise the samples by excluding groups of firms that are underrepresented in some countries, and therefore avoid conclusions led by the sample bias. In particular, firms with less than 10 employees, which correspond in general to micro-enterprises, were excluded. These correspond to a very significant proportion of the observations and show different coverage rates across the countries[4]. For firms with 10 or more employees, the coverage rate of the samples is more homogeneous between countries and always above 60%.

The selection criteria excludes a substantial number of observations. Nevertheless, the selected sample maintains a high representativeness of non-financial corporations when evaluated by assets, number of employees or EBITDA[5]. The sample selected for calculating the ECI includes around 3.8 million records, relatively well balanced through the 2008-2018 period (Table 1). France and Italy represent the highest proportion of the observations (30% for both countries), followed by Spain (21%), Portugal (12%) and Belgium (6%).

The distribution by economic activity is similar across countries and shows no bias towards certain economic sectors (Table A.1, in Appendix). Construction, wholesale and retail trade, and technical and administrative activities, are the activities that represent more observations in the sample. Industries (sections B and C of NACE Rev.2) account for between 20% (Belgium) and 41% (Italy) in the total sample, while Trade (section G) accounts for between 19% (Italy) and 28% (Belgium) of observations.

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information obtained from national accounting standards. With the growing importance of microdata, the ECB and the BACH Working Group made the BACH microdata available to internal users from the ECB and the National Central Banks of the six countries involved in the project, including Banco de Portugal.

3.   The iBACH database covers firms belonging to the non-financial corporations (NFC) sector. The terms 'firm', 'company' or 'enterprise' are used indistinctively in this study, and refer to the NFC sector, which excludes sole proprietorships (integrated in the institutional sector of Households).

4.   Considering the Structural Business Statistics (Eurostat) as the reference population of non-financial companies operating in each country, the iBACH samples show an overall coverage of between 9.6% for France and 63.2% for Belgium. Firms with less than 10 employees are the most underrepresented (coverage rates between 5% in the case of France and 46.7% in the case of Portugal).

5.   The sample selected for Portugal represents 11% of active firms, 55% of assets, 68% of EBITDA and 72% of the employees observed for the population of resident companies. For the samples relating to Belgium and Italy (which are collected, as in the case of Portugal, from censitary sources) the representativeness of the samples show similar figures.

| | Belgium | Spain | France | Italy | Portugal | Total |
|---|---|---|---|---|---|---|
| **2008** | 19 622 | 60 975 | 86 658 | 83 612 | 46 749 | **297 616** |
| **2009** | 20 123 | 73 228 | 88 930 | 86 316 | 45 017 | **313 614** |
| **2010** | 20 436 | 73 106 | 91 985 | 91 740 | 46 494 | **323 761** |
| **2011** | 21 754 | 74 400 | 97 102 | 97 267 | 45 117 | **335 640** |
| **2012** | 22 295 | 70 537 | 101 521 | 100 941 | 41 690 | **336 984** |
| **2013** | 22 836 | 69 247 | 104 603 | 103 534 | 39 729 | **339 949** |
| **2014** | 23 263 | 74 186 | 108 628 | 107 037 | 39 902 | **353 016** |
| **2015** | 23 672 | 76 407 | 112 483 | 111 029 | 41 734 | **365 325** |
| **2016** | 24 384 | 80 748 | 117 752 | 121 134 | 43 243 | **387 261** |
| **2017** | 24 918 | 82 909 | 123 463 | 133 192 | 45 074 | **409 556** |
| **2018** | 24 761 | 73 148 | 128 504 | 140 938 | 47 302 | **414 653** |
| **Total** | **248 064** | **808 891** | **1 161 629** | **1 176 740** | **482 051** | **3 877 375** |
| **%** | **6%** | **21%** | **30%** | **30%** | **12%** | **100%** |

TABLE 1. Number of enterprises | Sample used for ECI calculation

Source: iBACH (micro Bank of Account of Companies Harmonized), ECCBSO (European Committee of Central Balance Sheet Data Offices) and **?**.

The assets' median value in the sample is between 979 thousand euros (Portugal) and 2.7 million euros (Belgium) (Table 2). Concerning EBITDA, the median value is between 71 thousand euros (Portugal) and 315 thousand euros (Belgium). With regard to the number of employees, the samples show more similarities across countries, the median value standing between 17 (Spain and Italy) and 22 (France). As firms with less than 10 employees were excluded (which correspond mainly to micro-enterprises), the sample is mainly composed of small, medium and large companies.

| | Assets | EBITDA | Employees |
|---|---|---|---|
| Belgium | 2 756 | 315 | 20 |
| Spain | 1 390 | 85 | 17 |
| France | 2 209 | 216 | 22 |
| Italy | 2 674 | 204 | 17 |
| Portugal | 979 | 71 | 18 |

TABLE 2. Assets, EBITDA and Employees median values | Sample used for ECI calculation (2008-2018)

Source: iBACH (micro Bank of Account of Companies Harmonized), ECCBSO (European Committee of Central Balance Sheet Data Offices) and Lourenço *et al.* (2022).
Notes: Assets and EBITDA in thousands of euros. Median values for the total set of observations (2008-2018).

## 2.4. *Dimensions of analysis and respective basic indicators*

This section describes the dimensions on which the ECI is based and summarises the reasons for choosing the indicators underlying such dimensions. A more detailed explanation of the selection of the different indicators, including references to empirical literature in this area, can be found in **?**.

**Dimension 1 – Return.** This dimension aggregates two return ratios, namely, return on assets and return on equity (Table 3). Return on assets assesses the return and efficiency

in the use of resources. Return on equity represents a measure of return on investment on the company. Although correlated, these two indicators reflect, respectively, the return obtained and the profit orientation of firms.

| Indicator | Formula | Impact |
|---|---|---|
| Return on Assets (ROA) | EBITDA/Assets | + |
| Return on Equity (ROE) | Net income/Equity | + |

TABLE 3. Indicators of return

In a comparative analysis, these measures have the limitation of focusing on the short-term. Indeed, investment decisions or the margin to be applied in the goods and services produced may determine lower levels of profitability over a certain period of time, with a view to developing a comparative advantage in the longer term. The creation of a firm-level variable covering several years presupposes, however, a restriction of the sample to the companies active over the years considered. Furthermore, defining the number of years to be included in this indicator would be difficult, as what short-term is differs depending on, among other factors, the age of the company.

It is also important to take into account that the return on equity reflects the financing decisions of companies. Companies with higher levels of indebtedness (through recourse, for example, to bank loans) may have a higher return on equity given the lower preponderance of equity. On the other hand, such financing channel is likely to lead to lower profits due to the impact of financing costs. These dynamics must be considered in the evaluation of this indicator, particularly taking into account the existence of structural differences in the financing decisions of companies from different countries.

**Dimension 2 – Production Costs.** The concept of cost competitiveness is often discussed at the micro and macroeconomic levels. The principle underlying the use of cost indicators is that the higher the coverage of production costs (either by cost reduction or by increasing the obtained return), the higher the firm's competitiveness. The assessment of the production costs dimension as a determinant of firm competitiveness is carried out using the indicators of coverage of production factors' cost presented on Table 4.

| Indicator | Formula | Impact |
|---|---|---|
| Gross margin | GVA/Assets | + |
| Coverage of personnel expenses by GVA | GVA/Personnel expenses | + |

TABLE 4. Indicators of production costs

It should be noted that the production of appealing goods and services is also based on factors such as quality, product differentiation, relationship with the consumer (among others), which influence total production costs, but can be decisive for the

company's success in the market (Artto 1987). In fact, costs are a determinant of competitiveness especially in the sectors with homogeneous products (Depperu et al (2005)). Thus, an assessment of cost-competitiveness should take into account product homogeneity, which is not possible within the scope of the indicator used in this article (although such limitation may be partially overcome by the presentation of results by sectors of activity and size cohorts).

**Dimension 3 – Productivity**. The third dimension of the composite indicator is the efficiency of production factors, through measures of labour and capital productivity. This dimension consists of three indicators: labour productivity, capital intensity (fixed assets per employee) and weight of fixed assets on total assets, as shown on Table 5. The use of labour productivity, calculated on the basis of the number of employees, reflects the unavailability in the database of information about hours worked.[6]

| Indicator | Formula | Impact |
|---|---|---|
| Labour productivity | GVA/Number of employees | + |
| Capital intensity | Fixed assets/Number of employees | + |
| Weight of fixed assets on total assets | Fixed assets/Assets | + |

TABLE 5. Indicators of productivity

A positive correlation between productivity and competitiveness is a consensual result in the literature. However, the causal relationship suggested by the construction of the composite indicator, with productivity as an input variable for firms' competitive potential, does not have empirical support. In fact competitiveness and productivity are essentially interdependent phenomena.

**Dimension 4 – Access to Resources.** Access to production resources – physical capital, labour and human capital, technology and raw materials – is a determinant of competitiveness. The information in the database allows the calculation of indicators for access to capital and an indicator for access to the labour, used as an approximation to human capital. The indicators that make up this dimension are detailed in Table 6.

With regard to capital, the empirical evidence related to the importance of diversifying funding sources, namely through alternatives to bank financing, justifies the inclusion of the indicator of access to other types of debt. It is expected that a greater access to non-bank financing will lead to a higher value of the composite indicator, keeping everything else constant.[7]

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6. This indicator should be analysed with special care when applied to the years affected by the pandemic, since the employment protection measures implemented in several countries (as is the case of simplified layoff) give rise to different results depending on whether labour productivity is based on the number of employees or hours worked.

7. The diversification of financing sources has been promoted by public policies in recent years, taking into account the excessive dependence of European companies on bank loans, with an emphasis on Portuguese companies in this regard.

| Indicator | Formula | Impact |
|---|---|---|
| Weight of non-bank financing | Non-bank Financing / Liabilities | + |
| Weight of permanent funds on assets | Long-term liabilities plus equity/Assets | + |
| Cost of debt | Financing costs/Debt | - |
| Wage premium | Average personnel expenses of firm as a proportion of the median average personnel expenses of sector | + |

TABLE 6. Indicators of access to resources

Note: Non-bank financing corresponds to firm's liabilities deducted from loans from credit institutions and financial companies, including debt securities, inter-company financing and trade credits.

The weight of permanent capital in assets reflects the companies' access to «patient» capital, more suited to the financing of long-term investment projects.

With regard to labour, the wage premium was included in the construction of the composite indicator as an approximation to human capital – considered as a determinant of productivity and competitiveness. The inclusion of this indicator assumes that the existence of a wage premium may indicate the hiring of workers with relatively higher qualifications. Notwithstanding its limitations in assessing the role of human capital in firms' performance, there is empirical evidence in the literature of a positive causal relationship between the wage premium and firms' export activity.

**Dimension 5 – Risk.** This dimension includes, as a way of measuring companies' risk, indicators that relate debt of firms to their ability to pay it, as well as solvency and liquidity indicators (Table 7). In particular, the relationship between the amount of debt and the financial capacity of the company to pay principal and interest translates into a measure of the risk of bankruptcy.

| Indicator | Formula | Impact |
|---|---|---|
| Coverage of financing costs by EBITDA | EBITDA/Financing costs | + |
| Solvency ratio | Equity/Liabilities | + |
| Liquidity | Current assets/Current liabilities | + |

TABLE 7. Indicators of risk

Such risks can affect competitiveness, namely through the effect they can have on costs, the quality of goods and services produced or financial health. Several studies have analysed the relationship between company risk and productivity dynamics, concluding that the internal unavailability of funds and indebtedness have negative effects on that dynamics.

**Dimension 6 – Orientation for quality.** Such dimension identifies the process of developing competitive advantages, through differentiation or quality of the goods and services produced. It is evaluated through two indicators (Table 8). The weight of intangible assets on total assets reflects the relevance of assets associated with

intellectual property rights, among others, on the assets used in productive activities. The investment rate reflects the annual growth of fixed assets.

| Indicator | Formula | Impact |
|---|---|---|
| Weight of intangible assets on fixed assets | Intangible assets /Fixed assets | + |
| Investiment rate | Change in fixed assets/ Fixed assets (t-1) | + |

TABLE 8. Indicators of orientation for quality

The first measure intends to assess the technological sophistication of the production process as an approximation to orientation towards quality. This indicator therefore has a positive impact on the total composite indicator, which is supported by empirical evidence. In general, a greater weight of intangible assets is associated with a larger total factor productivity, both contemporaneously and in the immediate future. The investment rate is intended to assess the future development of competitive capacity through innovation, production sophistication or restructuring of the production process, with a view to increasing productivity. Despite the consensual importance of investment for productivity, this indicator has some measurement limitations, which can originate the somewhat ambiguous effects found in the literature. The difficulty in establishing a causal link may also be due to a lag between the moment of investment and the moment of impact.[8]

## 2.5. Composite indicator calculation

As described in the previous section, the composite indicator of firm-level competitiveness is composed of six dimensions comprising 16 indicators in total. In order to aggregate the different indicators within the corresponding dimensions, they are previously subject to a normalization procedure known as «min-max». For each of the indicators, this procedure places the performance of a company within the respective sector in a normalised scale that varies between 0 and 1, which is constructed as follows:

(i) for each indicator $X$, with a positive relationship with competitiveness (a higher value has a positive impact on competitiveness), the value for company $j$, in sector $s$ and in year $t$ on the normalised scale is obtained as[9]

$$0 \leq (X_{j,s,t} - MinX_{s,t})/(MaxX_{s,t} - MinX_{s,t}) \leq 1;$$

(ii) for indicators with a negative relationship with competitiveness (in this exercise, only the cost of debt), the value for company $j$, in year $t$ and in sector $s$ on the normalised scale is calculated as

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8. Measurement of orientation for quality could benefit from information on investment in Research & Development, which is not available in the database.

9. Prior to this calculation and in order to eliminate possible reporting errors, values below the 1st percentile and above the 99th are eliminated for each indicator.

$$0 \leq (MaxX_{s,t} - X_{j,s,t})/(MaxX_{s,t} - MinX_{s,t}) \leq 1.$$

Thus, the value 0 in the normalised scale for a given year corresponds to the firm that had the worst performance in its sector for a given indicator, while the value 1 corresponds to the firm that had the best performance. This procedure is applied pooling all firms in the set of countries in the database, for each of the abovementioned indicators.

The calculation of the composite indicator for each company and a given year is based on an uniform weighting structure both for each of the six dimensions, and for each of the different standardised indicators associated with each dimension. The granularity of the information thus obtained – a value of the composite indicator of competitiveness for each company and year – allows the aggregation to be carried out both at the level of the sector or size class, as well as at the level of the country, in any percentile of the distribution. Thus, both the transversal analysis and the longitudinal analysis of the composite indicator can be based on the median of the distribution, but also, for example, on the least (most) competitive companies, by looking at the lower (upper) percentiles of the distribution. Due to the way it is constructed, the value of the composite indicator is not susceptible of being interpreted in absolute terms, allowing only to assess the relative competitiveness performance of each country, sector or size class, globally or in each of the dimensions of analysis and indicators.

## 3. Results

Results indicate that Portuguese companies registered, in the analysed period, levels of competitiveness systematically lower than those observed by companies of the remaining analysed countries. In the opposite situation, French companies presented consistently the highest levels of competitiveness given the comparison between the ECI medians for each country (Figure 1).

Between 2008 and 2012, the competitiveness of the median Portuguese company registered an increase, although on a smaller scale than what was observed in the remaining analysed countries. Between 2013 and 2015, there was a broad decrease in the competitiveness of the median company in the various countries.

In the most recent period (2015-2018), Portugal recorded the highest growth of the median value of the ECI among the countries considered. In a framework of relative stability of this indicator in the remaining countries, there was a reduction in the difference between the Portugal's median ECI and the one observed by the best performer country, in this case France. In fact, the reduction of this differential is registered since 2013, after the increase observed between 2009 and 2012.

Between 2013 and 2015, the approximation of the Portugal's median ECI in relation to the value of the best performer country resulted essentially from the generalised reduction of the median value of the ECI, which was more significant in the remaining countries. This evolution was not due to the worse performance of these countries median companies, but to the recovery of the performance levels of companies with
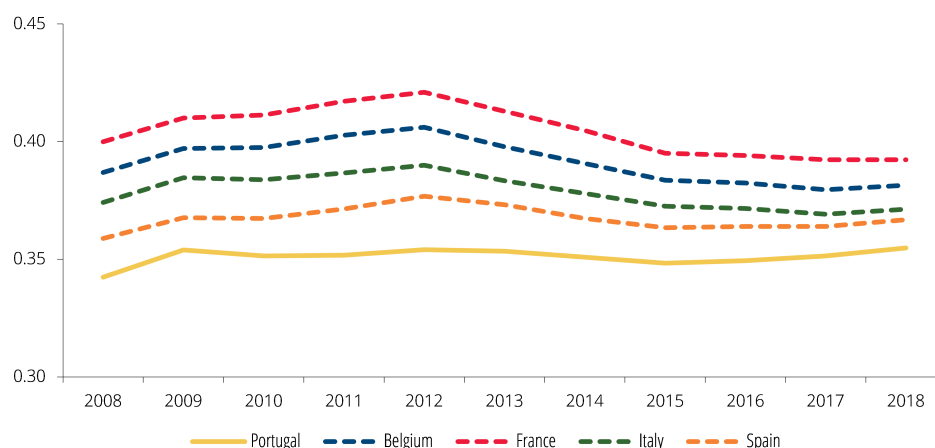
FIGURE 1: ECI | Median of the distributions by country

Source: iBACH (micro Bank of Account of Companies Harmonized), ECCBSO (European Committee of Central Balance Sheet Data Offices) and Lourenço *et al.* (2022).
Notes: The ECI corresponds, for each company, in each year, to its average position vis-à-vis companies with the worst and the best performances in their sector of activity in relation to each indicator, weighted having into account the procedure described in the previous section. The ECI has a value between 0 (worst performer) and 1 (best performer). The ECI has no absolute meaning and must be interpreted as a relative positioning of the companies in the set of countries presented. The figure shows the median values for the ECI for companies located in each country.

the worst performance during this period (which recorded historically low performance levels for some indicators in the years after the 2008 financial crisis), which brought the worst performer closer to the median company in all countries.

As of 2016, the median value associated with Portuguese companies registered an increase higher than that recorded in the remaining countries, suggesting an effective recovery Portuguese companies' competitiveness.

This evolution is relatively broad across the set of national companies, with a clear shift of the ECI's estimated distributions for Portugal towards the right between 2008 and 2018 (i.e., towards higher ECI levels), despite its relative stability (Figure 2). This situation contrasts with that evidenced in the cases of Belgian and Spanish companies, where slight shifts to the left of the respective distributions are observed. It is important to note, in any case, the smaller dispersion of the distributions estimated for 2018, which indicates greater homogeneity, among the various countries, of the relative competitiveness indicator.

The relative position of the countries under analysis does not change when companies with the worst or best competitive performance considering the ECI are considered. Portuguese companies show, in any case, values lower than the ones observed in the remaining countries analysed. Even so, Portugal's distancing is higher when considering companies with the worst performance (10th percentile of the distribution). However, these companies are the ones that since 2012 have most converged compared to the companies of the best performing country.

In the case of companies with the best performance (90th percentile), there is also a convergence of Portuguese companies vis-à-vis those of the best performing country
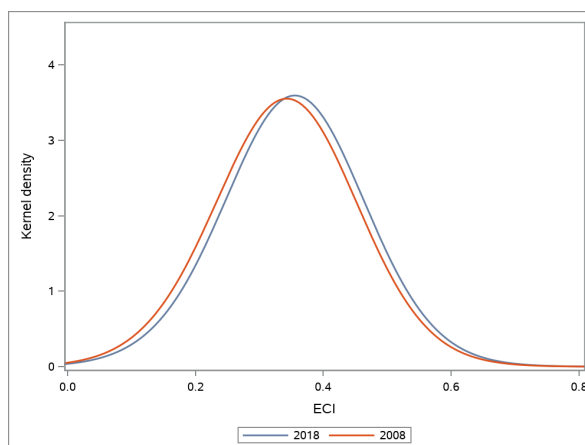
FIGURE 2: Portugal | ECI estimated Kernel density in 2008 and 2018

Source: iBACH (micro Bank of Account of Companies Harmonized), ECCBSO (European Committee of Central Balance Sheet Data Offices) and Lourenço *et al.* (2022).
Notes: The ECI corresponds, for each company, in each year, to its average position vis-à-vis companies with the worst and the best performances in their sector of activity in relation to each indicator, weighted having into account the procedure described in the previous section. The ECI has a value between 0 (worst performer) and 1 (best performer). The ECI has no absolute meaning and must be interpreted as a relative positioning of the companies in the set of countries presented. The figure shows the ECI distributions of Portuguese companies in 2008 and 2018.

since 2012, albeit on a smaller scale. However, in this case the convergence was linked in particular to the worst performance of companies in the best performing country (Figure 3).

These results indicate that the reduction of the competitiveness differential of Portugal relative to the country with the best performance reflects, to a greater extent, the catching up of Portugal's less competitive companies to the performance levels of the least competitive companies in the remaining countries.

The lower competitiveness of Portuguese companies largely reflects the evolution of the dimensions associated with productivity and access to resources, where the performance of the median Portuguese company has been considerably lower than that of the remaining countries considered (Figure 4). Although with a lower contribution, the lower competitiveness of Portuguese companies also reflects the performance recorded in the dimension relating to quality orientation.
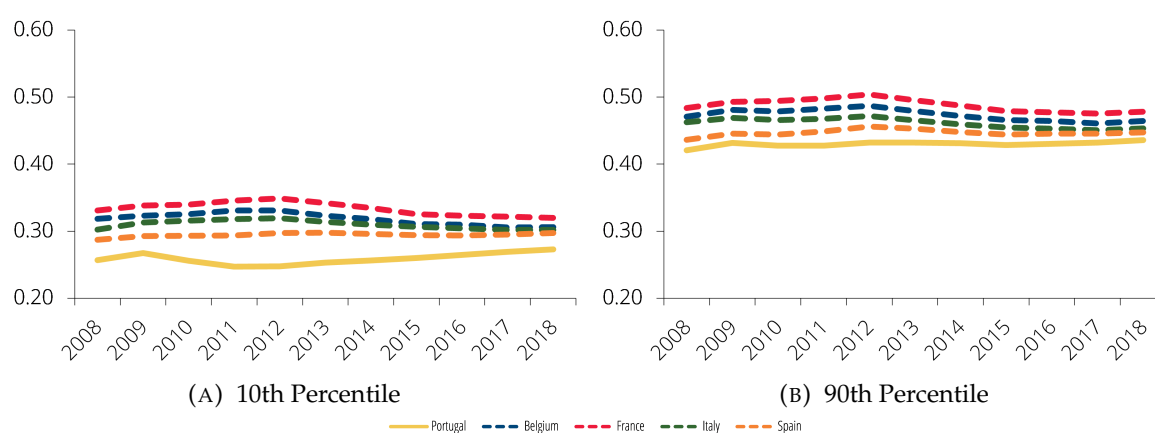
FIGURE 3: ECI | 10th and 90th percentiles of distributions by country

Source: iBACH (micro Bank of Account of Companies Harmonized), ECCBSO (European Committee of Central Balance Sheet Data Offices) and Lourenço *et al.* (2022).

Notes: The ECI corresponds, for each company, in each year, to its average position vis-à-vis companies with the worst and the best performances in their sector of activity in relation to each indicator, weighted having into account the procedure described in the previous section. The ECI has a value between 0 (worst performer) and 1 (best performer). The ECI has no absolute meaning and must be interpreted as a relative positioning of the companies in the set of countries presented. The figure shows the 10th and 90th percentiles for the ECI for companies located in each country. The 10th percentile is the value below which 10% of companies are situated, thus representing the upper limit for the 10% of companies with the worst performance for the competitiveness indicator. Likewise, the 90th percentile is the value below which 90% of companies are situated, which corresponds to the lower limit for 10% of companies with the best performance for this indicator.
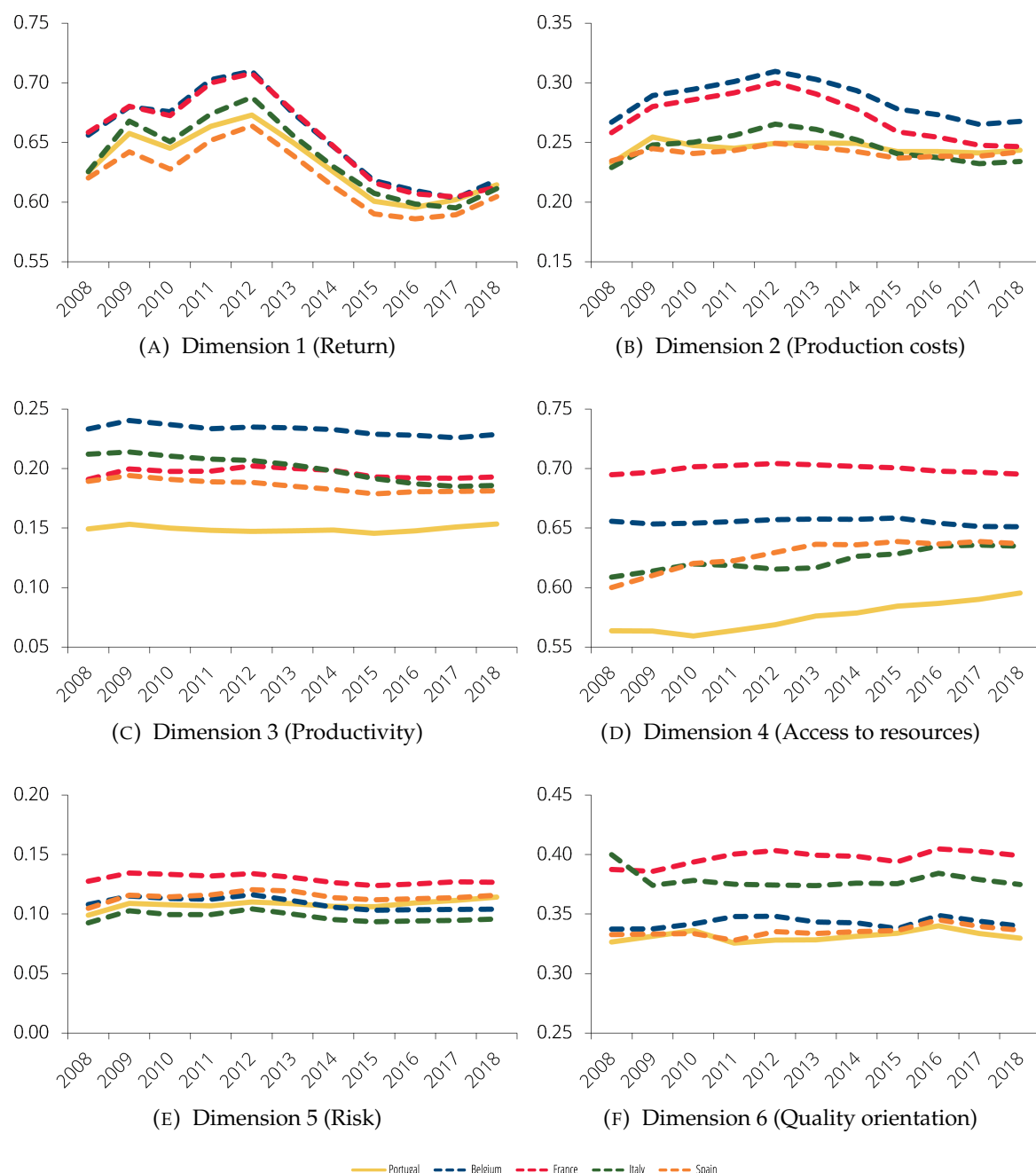
FIGURE 4: ECI dimensions | Median of the distributions by country

Source: iBACH (micro Bank of Account of Companies Harmonized), ECCBSO (European Committee of Central Balance Sheet Data Offices) and Lourenço *et al.* (2022).

Notes: Notes: The ECI dimensions correspond, for each company, in each year, to its average position vis-à-vis companies with the worst and the best performances in their sector of activity in relation to each indicator, weighted having into account the procedure described in the previous section. The ECI dimensions have a value between 0 (worst performer) and 1 (best performer). The ECI dimensions have a value between 0 (worst performer) and 1 (best performer). The ECI dimensions have no absolute meaning and must be interpreted as a relative positioning of the companies in the set of countries presented. The figure shows the median values for the ECI dimensions of companies located in each country. Lourenço *et al.* (2022) presents detailed results taking into account each of the indicators that contribute to the dimensions considered in the analysis (after the respective standardization).

The lower performance of Portuguese companies in the dimension associated with productivity reflects, in particular, the evolution of the components "Labour productivity" and "Capital intensity", with Portugal presenting values which tend to be lower than those observed in the remaining analysed countries. Conversely, in the "Weight of fixed assets on assets" component (third variable considered in this dimension), Portugal has the second best performance[10].

In terms of access to resources, the results of Portuguese companies derive from the "Wage premium" and "Access to non-bank financing" components, cases in which Portugal presents a relatively unfavorable position. "Wage premium" (proxy for human capital), calculated as the difference between the average salary of each company and the median salary of the respective sector, indicates that the less favorable performance of Portuguese companies may be linked to lower human capital qualifications or structural differences in the labor market. Conversely, the recent evolution of indicators such as "Weight of permanent funds on assets", "Cost of debt" and "Access to non-bank financing" (in the last two cases, in particular, from 2010-2012 onwards) have allowed Portuguese companies to get closer to the remaining countries regarding the dimension that takes into account the access to resources.

The worse performance of Portuguese companies in the quality orientation dimension stems from the fact that a greater proportion of Portuguese companies does not have intangible assets associated with its activity, determining a unfavorable positioning in the indicator "Weight of intangible assets on fixed assets".

Portugal assumes intermediate positions in the remaining dimensions, with emphasis on the positioning in some indicators linked to the return and production costs dimensions (namely in terms of "Return on Assets (ROA)" and "Coverage of personnel expenses by GVA"). In these cases, the performance of the Portuguese companies determines a relative position on the podium of the countries with the best median results at this level.

Results obtained indicate that the relative positioning of Portuguese companies compared to companies from the remaining analysed countries does not change substantially when the analysis is carried out by sector of activity or by company size. This situation points to a competitive differential of Portuguese companies vis-à-vis companies from the remaining countries, which results mainly from Portuguese companies' intrinsic characteristics, more than from differences in the business composition, both by sector and size.

Portugal shows lower levels of competitiveness than the remaining analysed countries in most sectors of activity, with electricity, gas and water being the only exception. In the most recent period, the difference between Portugal and the country with the level of competitiveness immediately above (taking into account the respective median of the ECI) was lower in trade, accommodation and food services. This was, with the exception of electricity, gas and water, the sector whose competitiveness has increased the most in the period under analysis (Figure 5).

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10. Lourenço *et al.* (2022) presents additional details on the distributions associated with each indicator.

These analyses are equally valid when considering additional sectoral breakdowns[11]. It is possible to point out, regarding the primary and secondary sectors, a convergence in terms of the competitiveness of Portuguese companies in the mining industry or in the manufacturing of electrical and optical equipment, among other examples. Also in construction and retail trade (within the tertiary sector) it is possible to highlight the convergence of Portugal with the countries with the best performance. However, besides electricity, gas and water, the results obtained with a higher level of disaggregation indicate that Portugal did not register the lowest levels of competitiveness only in postal and telecommunications services. Nonetheless, in any of these cases, only sporadically throughout the analysed period.

The relative positioning of Portuguese companies vis-à-vis the European peers analysed is confirmed when considering a breakdown by size class[12]. Also at this level, Portugal systematically presented, over the analysed period, medians of the distributions of individual values of the ECI lower than those of the remaining countries, regardless of the size class (Figure 6).

The lower competitiveness of Portuguese companies is more evident in smaller sized companies (with less than 50 employees), although this was the set of companies whose median ECI most increased (in a scale similar to that observed in companies with 250 or more employees). The smaller Portuguese companies even registered the greatest convergence vis-à-vis the country with the best results.

## 4. Final remarks

This paper sought to characterise the evolution of enterprises' competitiveness in Portugal, and in other four European countries, in the period 2008-2018. The analysis is based on the evolution of a new composite indicator of enterprises' competitiveness (ECI), which aggregates six important dimensions: return, production costs, productivity, resources availability, risk, and quality orientation. A striking feature in the Portuguese economy is that enterprises' competitiveness has always been below the competitiveness observed in the remaining countries. The article suggests that productivity and resources availability are the dimensions that may have contributed to this divergence. Nevertheless, Portuguese companies recorded a favorable evolution in recent years (2015-2018).

This article opens avenues to several studies on the evolution of companies' competitiveness in Portugal. First, the impact of the COVID-19 pandemic crisis on enterprises' competitiveness is of utmost importance for policy makers, an issue that can be analysed taking into account the relative performance of companies considering their positioning in terms of competitiveness. Second, the current indicator and subsequent

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11.   Lourenço *et al.* (2022) presents the detailed results for each of the distinct sectoral aggregates considered in the analysis.

12.   A classification by size class was considered in this analysis based on the number of employees in each year, taking into account four classes: from 10 to 19 employees, from 20 to 49 employees, from 50 to 249 employees and 250 or more employees.

analysis would benefit from additional data on specific dimensions like workers attributes or companies' export orientation would be critical to complement the analysis on dimensions not covered in the current article. Finally, increasing the number of countries covered in the sample will also contribute to a better understanding of enterprises' competitiveness in Portugal and Europe. The presence of these additional elements jointly with other econometric techniques is a challenge for future research.
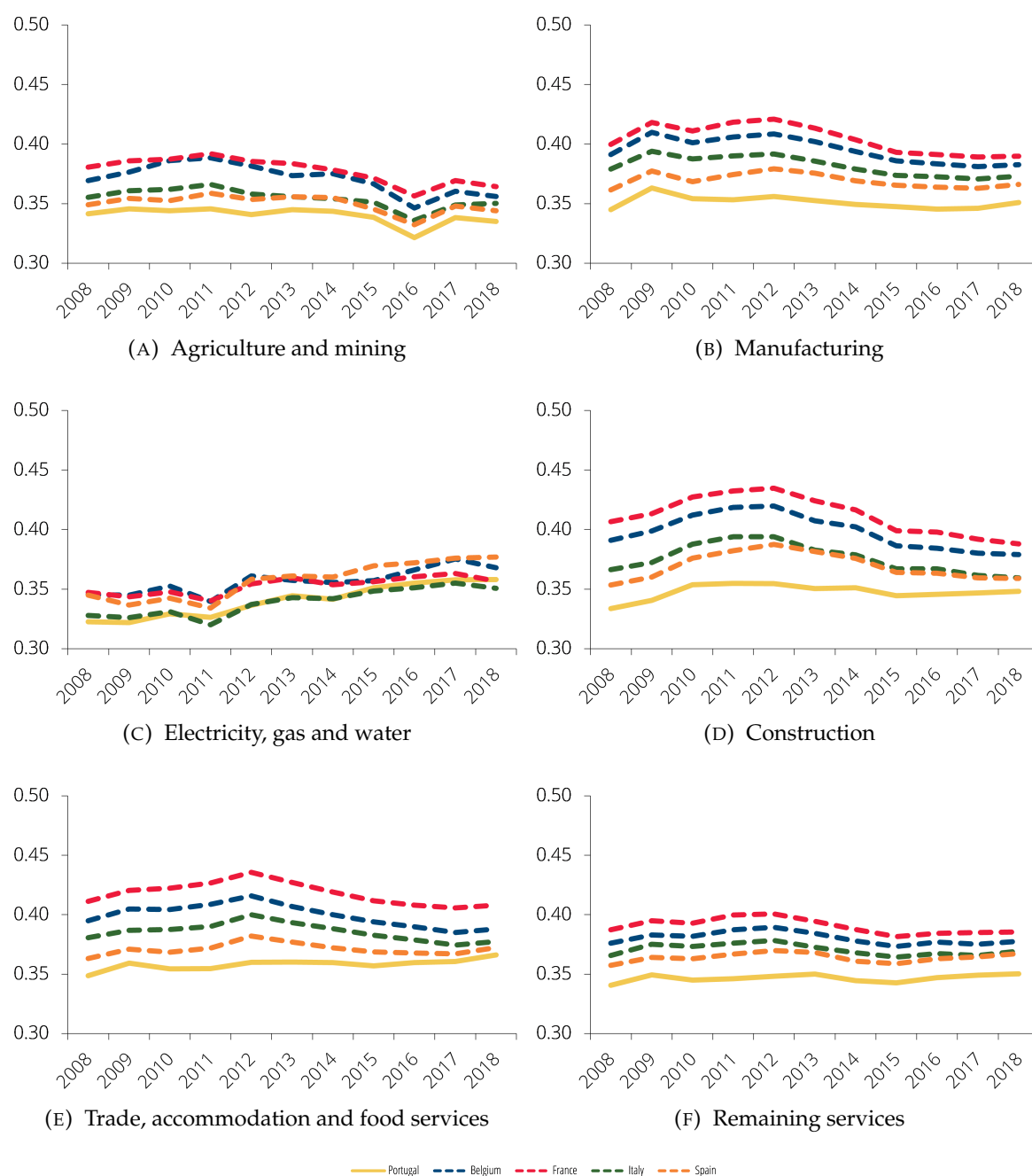
FIGURE 5: ECI | Median of the distributions by country and sector of economic activity

Source: iBACH (micro Bank of Account of Companies Harmonized), ECCBSO (European Committee of Central Balance Sheet Data Offices) and Lourenço *et al.* (2022).

Notes: The ECI corresponds, for each company, in each year, to its average position vis-à-vis companies with the worst and the best performances in their sector of activity in relation to each indicator, weighted having into account the procedure described in the previous section. The ECI has a value between 0 (worst performer) and 1 (best performer). The ECI has no absolute meaning and must be interpreted as a relative positioning of the companies in the group of countries presented. The figure shows, for each sector, the median values for the ECI. Sector information was aggregated into six broad categories of activity (Agriculture and mining - which includes companies associated with Sections A e B of NACE Rev.2; Manufacturing - Section C; Electricity, gas and water - Sections D and E; Construction - Section F; Trade, accommodation and food services - Sections G and I; Remaining services, which aggregates the remaining companies), which are broken down into 27 distinct sectoral aggregates. Lourenço *et al.* (2022) present the detailed results taking into account each of the distinct sectoral aggregates.

(A) From 10 to 19 employees

(B) From 20 to 49 employees

(C) From 50 to 249 employees

(D) 250 or more employees
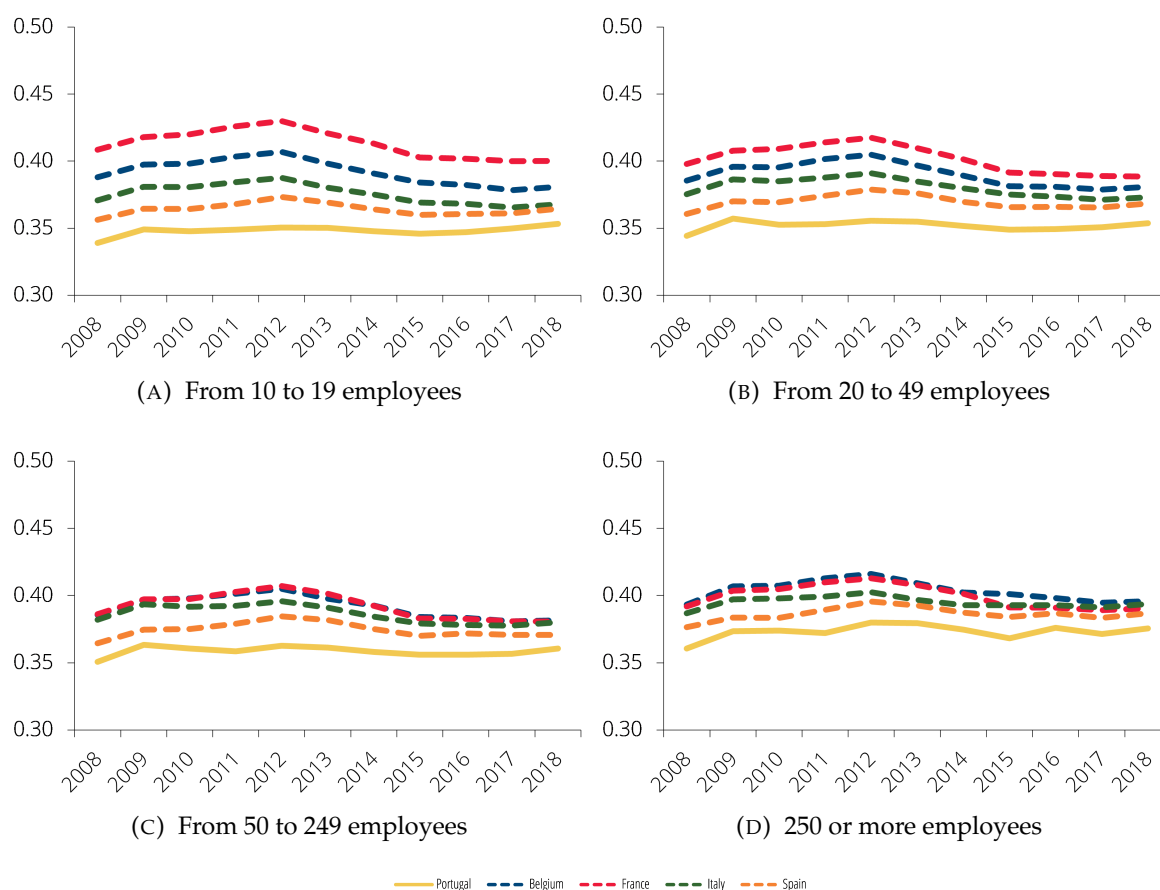
Portugal — — Belgium — — France — — Italy — — Spain

FIGURE 6: ECI | Median of the distributions by country and size class

Source: iBACH (micro Bank of Account of Companies Harmonized), ECCBSO (European Committee of Central Balance Sheet Data Offices) and Lourenço *et al.* (2022).

Notes: The ECI corresponds, for each company, in each year, to its average position vis-à-vis companies with the worst and the best performances in their sector of activity in relation to each indicator, weighted having into account the procedure described in the previous section. The ECI has a value between 0 (worst performer) and 1 (best performer). The ECI has no absolute meaning and must be interpreted as a relative positioning of the companies in the set of countries presented. The figure shows, for each size class, the median values for the ECI for the companies located in each country. The information by size classes results from the segmentation of companies into four classes, considering the respective number of employees in each year (taking into account that the analysis considered only companies with at least 10 employees).

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# Appendix

| Section - Activities | Belgium | Spain | France | Italy | Portugal |
|---|---|---|---|---|---|
| A - Agriculture and fishing | 1.1% | 2.6% | 1.1% | 0.9% | 2.5% |
| B - Mining | 0.2% | 0.5% | 0.4% | 0.4% | 0.5% |
| C - Food, beverages and tobacco products | 3.6% | 4.0% | 3.4% | 3.5% | 4.7% |
| C - Textiles | 1.2% | 2.3% | 1.0% | 4.9% | 8.6% |
| C - Wood and paper | 2.1% | 2.5% | 2.2% | 2.9% | 2.6% |
| C - Coke and refined oil products | 0.0% | 0.0% | 0.0% | 0.1% | 0.0% |
| C - Chemicals | 1.3% | 1.1% | 1.0% | 1.5% | 0.7% |
| C - Rubber and non-metallic minerals | 2.5% | 2.4% | 2.1% | 4.3% | 2.7% |
| C - Mechanical engineering | 4.6% | 4.5% | 4.4% | 9.6% | 4.2% |
| C - Optical and electric equipment | 0.9% | 0.8% | 1.2% | 2.7% | 0.6% |
| C - Machinery and equipment | 1.5% | 1.7% | 1.5% | 5.3% | 1.0% |
| C - Transport equipment | 0.5% | 0.7% | 0.6% | 1.3% | 0.6% |
| C - Other manufacturing | 2.0% | 2.6% | 2.7% | 4.2% | 2.8% |
| D/E - Electricity, gas and water | 0.8% | 0.8% | 1.0% | 1.8% | 0.8% |
| F - Construction | 14.9% | 11.7% | 15.7% | 11.0% | 13.7% |
| G - Vehicle sale and repair | 4.8% | 3.3% | 4.6% | 2.9% | 3.2% |
| G - Wholesale trade | 13.9% | 12.5% | 10.8% | 9.6% | 10.2% |
| G - Retail trade | 9.6% | 7.3% | 10.2% | 6.1% | 8.8% |
| H - Transportation and storage | 8.1% | 5.9% | 6.4% | 4.9% | 4.3% |
| H - Postal services | 0.2% | 0.2% | 0.0% | 0.1% | 0.1% |
| I - Accommodation and food services | 5.5% | 9.6% | 7.0% | 8.5% | 9.3% |
| J - Audiovisual | 0.7% | 0.8% | 1.4% | 0.9% | 0.6% |
| J - Telecommunications | 0.2% | 0.3% | 0.1% | 0.2% | 0.2% |
| J - Information technologies | 2.8% | 1.9% | 1.9% | 3.0% | 1.5% |
| L - Real estate activities | 1.0% | 0.8% | 1.3% | 0.2% | 0.8% |
| M/N - Administrative and technical activities | 11.7% | 10.5% | 12.5% | 6.9% | 8.7% |
| Other activities | 4.5% | 8.5% | 5.2% | 2.2% | 6.3% |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** |
| Industries | 20% | 23% | 21% | 41% | 29% |
| Trade | 28% | 23% | 26% | 19% | 22% |

TABLE A.1. Sample structure by economic activity | Sample used for ECI calculation