

# The Portuguese economy: Short essays on structural changes

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## Foreword

This collection of short-essays aims at fostering debate on the structural changes of the Portuguese economy in recent decades.

Portugal faced a number of important external and internal shocks in the recent decades. The adoption of the euro, the accession of China to the World Trade Organization, the EU enlargement to Eastern countries and, more recently, the financial and sovereign debt crisis highlighted the weaknesses of the Portuguese economy and questioned the ability of the country to grow.

It is thus important to take stock of the structural transformations that occurred in past years and assess their impact on economic growth. We start with an overview of the progress in the Portuguese educational system, both in terms of educational attainment and quality improvements, and examine its important contribution to supporting economic growth in the future. We then turn to the expected economic impact of the recent stabilization of the financial sector. The next two sections focus on the allocation of resources in the Portuguese economy, particularly between the tradable and the non-tradable sectors, and provide evidence on recent developments around the so-called zombie firms.

We conclude by shedding light on recent external competitiveness developments. In doing so, we highlight important limitations of standard measures, namely Total Factor Productivity and Unit Labour Costs, and draw attention to the inability of the latter to explain the recent recovery of firms' profitability. Drawing on a rich set of alternative, granular indicators, we aim at providing a better understanding of the non-cost competitiveness gains that have underpinned the improvements in the external performance of the Portuguese economy.

This collection of essays should be seen as work in progress. Comments and suggestions are greatly welcomed.

## Key messages

### 1. Education in Portugal – attainment, quality and potential output

This chapter presents a comprehensive analysis of the state and evolution of education in Portugal, using a range of different indicators. Data show that there was important progress in terms of educational attainment, with the ratio of low-skilled decreasing by almost 20 percentage points in the last decade. This was coupled with steady improvement in terms of educational quality, with Portugal progressing in all periods covered by the OECD PISA indicators. According to the existing literature, these results have important consequences for growth. For instance, by assuming that the current flows of young people into the labour force persist in the future, the low-skilled ratio in the overall population will decrease by 10 additional percentage points in the next decade, which we estimate will boost potential output by 7% over the same horizon.

### 2. Stabilization of the financial sector – an overview of economic impacts

This chapter discusses the expected macroeconomic impacts generated by the recent stabilization of the Portuguese banking sector. By reviewing existing literature on the effects of policies related to bank failure, recapitalization and the quality of the banks' balance sheets, we explore the transmission channels between healthy financial systems and the real economy. A well-established literature has shown that the stability of the financial system is critically important for economic growth, contributing also for the reduction of cyclical volatility. Finance has a more important impact on growth through fostering productivity growth and resource allocation than through pure capital accumulation. In particular, the availability of external finance is positively associated with entrepreneurship and higher firm entry as well as with firm dynamism and innovation. Finally, the literature also indicates that there are important non-linearities in the relationship between finance and growth. Financial sector deepening is not a goal in itself, rather it is a tool for economic growth.

### 3. Resource allocation: tradables and non-tradables

Given the importance of efficient resource allocation to fostering sustainable economic growth, we shed light on the developments that occurred in the Portuguese economy in the last two decades. The existing literature highlights the build-up of imbalances after the adoption of the euro, associated with a shift of resources to non-tradables. By relying on classification of tradable sectors based on exposure to international competition, we assess the dynamics of three key variables: labour, investment, and gross value added. We show that investment allocated to tradables is on a steady upward trend, while employment and gross value added have kept relatively stable shares across the two sectors. For the three variables, the weight of tradables is broadly in line with that in our European partners.

### 4. A glimpse at zombie firms

Firm-level data offers important insights on the so-called productivity paradox (i.e. the fact that Productivity growth is slowing down amid rapid technological progress and ever more educated labour force), by pointing at the divergence between the most productive firms (those at the frontier) and all the others (the laggards). Among several explanations, the increased prevalence of zombie firms – those that should leave the market under properly functioning economies – has

been put forward by the OECD as a possible driver. By relying on a rich set of firm-level data for Portugal, we show that the share of zombie firms has indeed increased up to 2013, but is now on a downward trend. Our analysis also shows that capital and labour sunk in these firms is significant (22% and 15%, respectively), harming the performance of all firms. Finally, by relying on an exit model, we claim that the changes in the insolvency framework enacted in recent years foster the exit of zombie firms, with overall gains for the economy.

## **5. TFP à la carte?**

TFP is often computed as a residual of a production function, and therefore the results are influenced by the choice of the functional form, the definition and measurement of outputs and inputs and the estimation algorithm. This chapter reviews the literature on TFP estimation methods, highlighting their important limitations and their high sensitivity to estimation methods. Using TFP data from different databases, such as AMECO, OECD and Penn World Table, we show that methodological choices and assumptions lead to vastly different TFP estimates, with differences in TFP growth rates reaching more than 1 percentage point. We propose more granular approaches to the estimation of TFP as a way of moving forward.

## **6. Unit Labour Costs and Portuguese External Competitiveness**

There is a fairly widespread view that Portuguese external competitiveness has deteriorated significantly in the run up to the recent crisis. This view is often predicated on conventional measures of Unit Labour Costs (ULC) growing above EU average. Yet, it is now well established in the relevant academic literature that ULC are an overly simplistic and potentially misleading indicator of external competitiveness. From 1995 to 2009, the wage share of income in Portugal has barely changed. This implies that ULCs have essentially tracked the Portuguese GDP deflator, which can hardly be seen as a good measure of external competitiveness. Other, more suitable measures are available and portray a very different picture of structural changes in the Portuguese economy and their effects on external competitiveness.

## **7. The recovery of firms' profitability**

Firms' profitability has recovered in recent years (2012-2015), with positive contributions from a variety of costs, only slightly offset by taxes and payroll expenditures. These developments were broad-based across firms in different sectors (apart from the utilities sector) and with different sizes, with a large number of SMEs moving from decreased to increased profitability.

## **8. Understanding export performance: beyond cost competitiveness**

We offer an overview of the Portuguese export performance in the last two decades. While there is broad agreement that this performance has been relatively successful, its drivers remain a source of debate. We contribute to this discussion by going beyond traditional export performance indicators, usually focused on cost-competitiveness. Relying on granular indicators of relative export prices and export market shares, we highlight the role of non-cost factors, which have allowed the country to make steady competitiveness gains.



# 1. Education in Portugal – attainment, quality and potential output

## Key messages

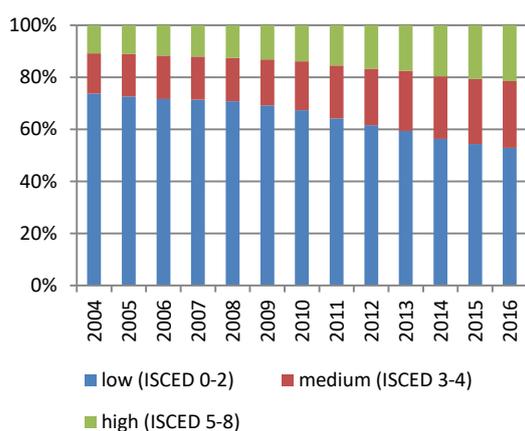
*This chapter presents a comprehensive analysis of the state and evolution of education in Portugal, using a range of different indicators. Data show that there was important progress in terms of educational attainment, with the ratio of low-skilled decreasing by almost 20 percentage points in the last decade. This was coupled with steady improvement in terms of educational quality, with Portugal progressing in all periods covered by the OECD PISA indicators. According to the existing literature, these results have important consequences for growth. For instance, by assuming that the current flows of young people into the labour force persist in the future, the low-skilled ratio in the overall population will decrease by 10 additional percentage points in the next decade, which we estimate will boost potential output by 7% over the same horizon.*

### i. Education level

Portugal has considerably improved its educational outcomes in recent years (Figure 1). Between 2004 and 2016, the share of adults (15-64 years old) with at most lower secondary education (ISCED levels 0-2) decreased by 21p.p., from 74% to 53%, while both medium and high skilled (ISCED levels 3-4 and 5-8, respectively) registered increases of around 10p.p., from 16% to 26% and from 11% to 22%, respectively.

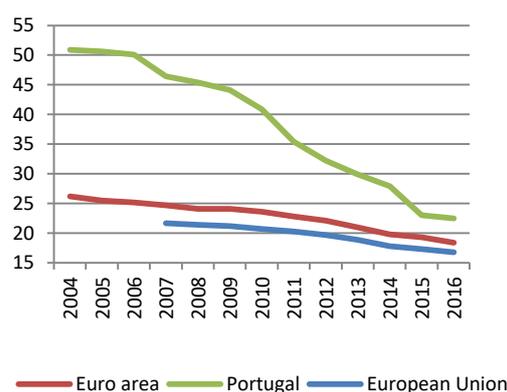
The qualification gap vis-à-vis the European partners remains large - the stock of low skilled is 26p.p. and 23p.p. above the EU28 and the euro area, respectively - but is falling at a fast pace (10p.p. since 2004) and is largely related to the legacy of older generations, with worse educational attainments.

**Figure 1 – Evolution of education levels, Portugal, 2004-2016**



Source: Statistics Portugal

**Figure 2 – Evolution of youth low-skilled (age 20-24), Portugal, 2004-2016 (as a % of those aged 20-24)**



Source: Eurostat

The flow of new low-skilled joining the labour force (proxied by the share of low-skilled among those aged 20-24; Figure 2) is very close to that of the euro area and EU (22%, 18% and 17%, respectively), having decreased 28p.p. between 2004 and 2016. According to OECD (2017), Portugal has achieved the second highest increase in education attainment between generations among OECD countries. The early school leaving rate fell significantly, from 40% to 14%, converging

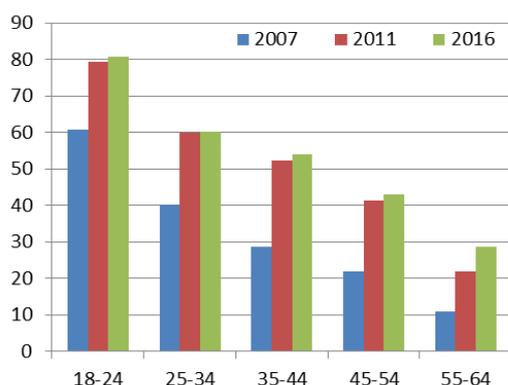
to the rates in the EU and euro area countries (both gaps felt from more than 20p.p. to 3p.p.). The revamp of vocational and professional training, as an alternative educational path, contributed to these improvements (Cruz, 2015), with the number of enrolled students almost tripling between 2004 and 2016 (from 39.597 in 2004 to 112.395 in 2016). In the same period, the number of students graduating from higher education increased by 9% (from around 67.000 to 73.000). Importantly, those graduating in scientific and technological fields increased by 70% (from 9 to 19 per thousand inhabitants), while the number of doctorates almost tripled.

As a result, in coming years further improvements are expected in the skill composition of the labour force. Even if one assumes no further improvements in terms of flows – which is a conservative assumption – the ratio of low-skilled adults is expected to drop from 53% in 2016 to 42% in 10 years (see Box 1).

Decreasing the stock of low-skilled adults is of paramount importance to boosting the growth potential of the Portuguese economy.

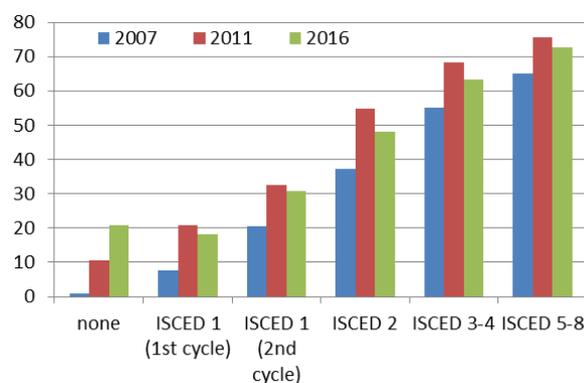
The relevance of adult education has been growing in recent years: more than 50% of the adults between 18 and 64 years old participated in lifelong learning activities in 2016, which represents an increase of almost 20p.p. compared to 2007. These improvements are broad-based, both in terms of age groups and educational attainment (Figures 3 and 4). At the same time, the share of the population who do not participate in any kind of education or training fell from 48% to 8% in the same period (Oliveira et al, 2017).

**Figure 3 – Proportion of people (18-64 years old) who participate in lifelong learning activities, by age group**



Source: Adult Education Survey in Oliveira et al (2017)

**Figure 4 – Proportion of people (18-64 years old) who participate in lifelong learning activities, by educational attainment**



Source: Adult Education Survey in Oliveira et al (2017)

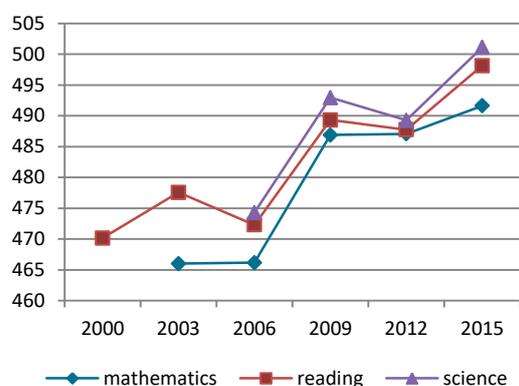
## ii. Education quality

Portugal was one of the few countries with steady significant improvement in all periods covered by the OECD PISA indicators (Figure 5). The latest results for 2015 show that the country is now above the OECD average in all domains. This is corroborated by the TIMSS results<sup>1</sup> (CNE, 2017), with significant improvements in the last two decades. Importantly, the developments achieved are broad-based, with enhanced results both for students with low and high-performance. For

<sup>1</sup> Trends in International Mathematics and Science Study (TIMSS) is an international evaluation of 4<sup>th</sup> grade students performance focused on maths and science developed by the International Association for the Evaluation of Educational Achievement.

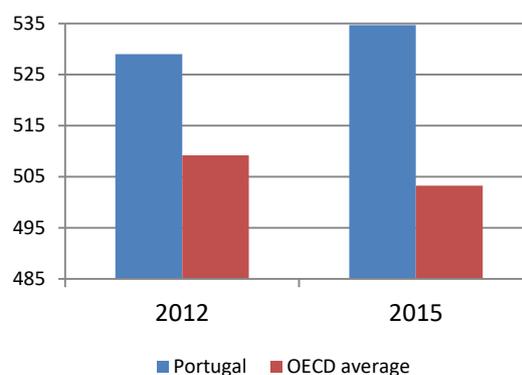
instance, the number of schools in disadvantaged areas that overachieved in math increased by 68% between 2003 and 2015 (PISA). At the same time, students without any grade repetition continue to strongly outperform their OECD peers (more than 30 points higher for all areas; Figure 6). This should reflect, at least in part, the benefits associated to targeted action to support students who repeated a grade<sup>2</sup>.

Figure 5 – OECD PISA results



Source: OECD PISA 2015

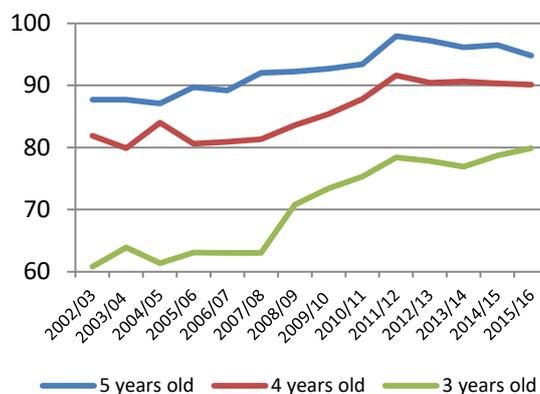
Figure 6 – OECD PISA results for students who did not repeat a grade (average of the three domains)



Source: OECD PISA 2015 and authors' own calculations

Empirical analysis shows the significant short- and long-term benefits of pre-school programs have on educational attainment (e.g. Currie, 2001) and on the performance reached at later stages (e.g. OECD, 2017b). 2015 OECD PISA results suggests this applies in Portugal: students with at least one year of pre-schooling scored, on average, more 60 points than students without pre-schooling. Given that pre-schooling coverage has been steadily improving (Figure 7), performance is expected to improve further in coming years.

Figure 7 – Pre-schooling rate (by age group)



Source: Directorate-General for Statistics of Education and Science.

### iii. Potential output

Recent improvements in educational attainment are likely to have sizeable effects on potential GDP growth. For instance, assuming that the current flow of low-skilled into the labour force is kept

<sup>2</sup> A tutorial support programme for students who repeated a grade more than once was implemented in 2016-2017, with a coverage rate of 82%, providing mentoring to 25.000 of the 30.000 eligible students.

constant (which is a conservative assumption, as described in Box 1), one would expect the share of low-skilled to be reduced further from the current 53% to 42% in 10 years, which in turn is expected to improve the level of potential GDP by 7% and 9% in 10 and 50 years, respectively<sup>3</sup>. There are also sizeable effects from further increases in the share of high skilled. For instance, Varga et al (2013) estimate that the impact of closing the gap vis-à-vis the average of the 3 top performers in the EU would be, in the long-run, close to 6%, a result in line with that in Varga and in't Veld (2014)<sup>4</sup>.

The results from these model simulations are in line with empirical studies that find a statistically significant positive association between years of schooling and long-run economic growth (Hanushek and Woessmann, 2016, de la Fuente and Doménech, 2001 and 2006, and Cohen and Soto, 2001), including both human capital level and accumulation (Ciccone and Papaioannou, 2005). Cedefop (2017) estimates an increase of 0.1p.p. of EU28 long term GDP per capita growth rate as a result of a reduction of 10p.p. in the long-term proportion of low-skilled adults, which increases to 0.23p.p. in the case of a 10p.p. increase of tertiary level skills<sup>5</sup>. Moreover, according to Queiró (2016), more educated managers have a significant positive effect firms' growth (stronger for degrees in engineering, science, health and business). Accordingly, closing the gap to the U.S. managers' education distribution would raise aggregate productivity in Portugal by 33%, accounting for half of the gap in output per capita between the two countries.

On top of the gains from higher educational attainment, quality improvements also have a positive impact on growth. Although more difficult to quantify, Aguiar, Ribeiro and Gil (2017) estimate that improvements in the quality of education in Portugal, between 2010 and 2012, contributed to a potential GDP increase of 0.7% in the long-run. These model based estimates are corroborated by econometric analysis. For instance, Hanushek and Kimko (2000) find, for a panel of countries, including Portugal, a statistically and economically significant positive effect of the quality of education on economic growth between 1960 and 1990. Woessman (2014) concludes that an increase of 50 PISA points translates into 1p.p. higher long-term economic growth rates. Between 2000 and 2015, Portugal improved PISA scores by approximately 30 points, which, taking the previous result as reference, translates into a 0.6p.p. boost in growth rates.

#### **Box 1 – Projection of low-skilled ratio in ten years**

For the computation of the projection of the ratio of low-skilled among adult population in Portugal in the coming 10 years, we departed from the current skill structure for the different age groups (INE – Statistics Portugal data for population by educational attainment level and age). Based on the assumption that the low-skilled share will continue to be the same for the youngest population groups (15-19 and 20-24 years old), we estimate the changes of the overall skill structure of the total adult population in the coming 10 years. Past experience shows that policy action brings sustained gains and the remaining gap vis-à-vis European partners – although substantially reduced in past

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<sup>3</sup> These estimates were computed using the European Commission's QUEST III model, a DSGE model with semi-endogenous growth. For further details, please refer to Gouveia and Fernandes (2017).

<sup>4</sup> In the model used, high-skilled are defined as human resources in science, mathematics and computing, engineering, manufacturing and construction and do not correspond to the commonly used ISCED 5-6 education attainment definition.

<sup>5</sup> Notwithstanding, literature also highlights other benefits of higher skill levels for society. Participation in education has a range of non-market benefits that extend into personal life and the community, namely higher level of civil participation, self-rated satisfaction with job and finance situation, better health and well-being, higher social trust, greater political interest, lower political cynicism, and less hostile attitudes towards immigrants, among others (see Cedefop, 2017 for a review).

years - indicates that there is margin to further improve. In this exercise, however, we consider that the current skill share for adults between 15 and 24 years old is kept at the current level, thus allowing us to focus solely on the carryover effect.

In this setting, for the projection of the low-skilled share for each age group, we consider an annual transfer of population at the age limit of each group to the next group (in line with the population projections by age from Statistics Portugal), bringing with them the qualification structure of the preceding group.

The transition equation is computed in the following way (using the age group 25-34 to exemplify the computation):

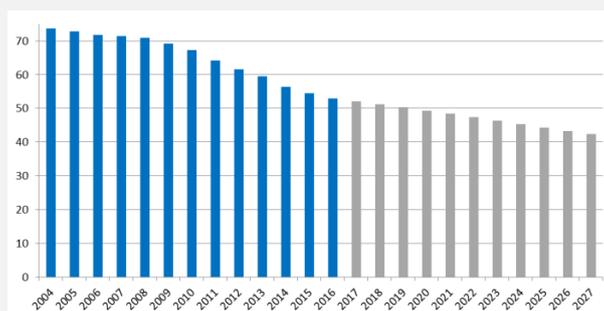
$$LS_t(25 - 34) = LS_{t-1}(25 - 34) + \frac{Pop_t25}{Pop_t(25 - 34)} * LS_{t-1}(15 - 24) - \frac{Pop_t35}{Pop_t(25 - 34)} * LS_{t-1}(25 - 34)$$

Where  $Pop_t$  denotes the population at a certain age or age group at year  $t$ , and  $LS_t$  denotes the share of low-skilled workers inside an age group.

Thus, the low-skilled share for the entire economy results from the weighted average of the qualifications of each group by the corresponding population:

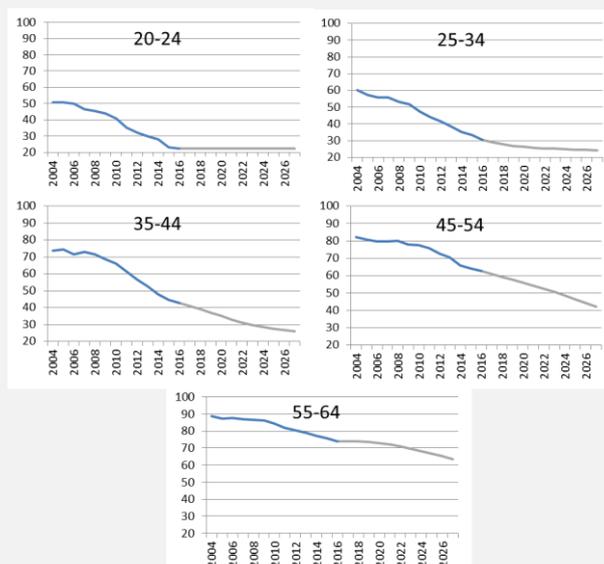
$$LS_t = \sum \frac{LS_t(X - x)}{Pop_t(X - x)}$$

**Figure 1.1 - Low-skilled share dynamics (% , overall)**



Source: Statistics Portugal and authors' own computations.  
Note: Grey bars are the computed estimates.

**Figure 1.2 - Low-skilled share dynamics (% , by age group)**



Source: Statistics Portugal and authors own computations.  
Note: Grey lines are the computed estimates.

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## 2. Stabilization of the financial sector – an overview of economic impacts

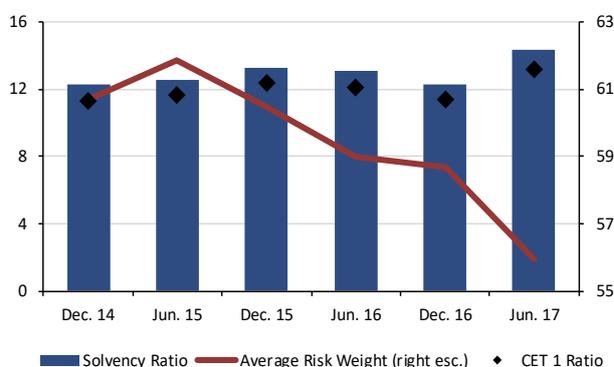
### Key messages

*This chapter discusses the expected macroeconomic impacts generated by the recent stabilization of the Portuguese banking sector. By reviewing existing literature on the effects of policies related to bank failure, recapitalization and the quality of the banks' balance sheets, we explore the transmission channels between healthy financial systems and the real economy. A well-established literature has shown that the stability of the financial system is critically important for economic growth, contributing also for the reduction of cyclical volatility. Finance has a more important impact on growth through fostering productivity growth and resource allocation than through pure capital accumulation. In particular, the availability of external finance is positively associated with entrepreneurship and higher firm entry as well as with firm dynamism and innovation. Finally, the literature also indicates that there are important non-linearities in the relationship between finance and growth. Financial sector deepening is not a goal in itself, rather it is a tool for economic growth.*

This essay discusses the expected macroeconomic impacts generated by the stabilization of the banking sector. This issue is particularly relevant in Portugal, given recent developments in the banking sector (for an overview, see Banco de Portugal, 2017a and Pereira and Filipe, 2016).

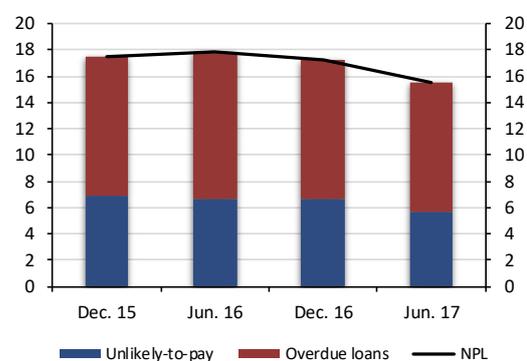
The stabilization of the Portuguese banking system involved the strengthening of banks' capital base (Figure 8), the improvement of asset quality (Figure 9), the clarification of responsibilities for resolution operations and the continuous improvement of the sector's operational results (Figure 10). According to Banco de Portugal (2017b), the return of assets in the Portuguese financial system has improved since 2013, reaching the EU-15 average<sup>6</sup>. On asset quality, the situation concerning non-performing loans is improving, as NPLs on banks' balance sheets are in a steady downward trend since June 2016 and coverage ratios are growing since 2013. For an overview of the recent developments in the Portuguese financial system, please see Box 2.

**Figure 8 – Common Equity Tier 1 ratio, total solvency ratio and average risk weight**



Source: Financial Stability Report, 2017c, Banco de Portugal

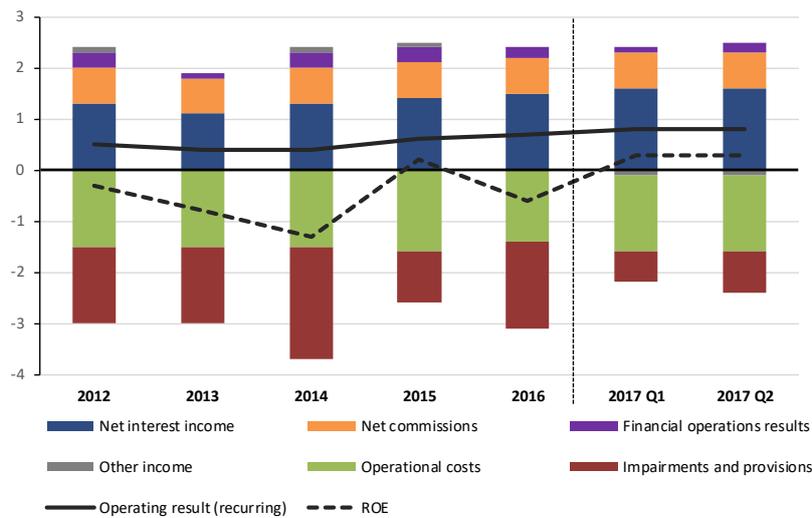
**Figure 9 – Non-Performing Loans**



Source: Financial Stability Report, 2017c, Banco de Portugal

<sup>6</sup> For an overview on the efficiency and profitability of the Portuguese financial system, see Banco de Portugal (2017b and 2016).

**Figure 10 – Income and costs, in % of average total assets**



Source: Portuguese Banking System, 2017a, Banco de Portugal

### Box 2 – The recent stabilization of the Financial Sector in Portugal (2015-2018)

In the recent years, much of the stabilization of the financial system has been achieved through banks' recapitalization and shareholder structure changes, namely:

- Banif resolution and integration of Banif business in Santander– 2015,
- successful capital raising by BCP (including the acquisition of an important part by the Fosun group) – 2016 and 2017,
- acquisition of BPI by La Caixa and reducing exposure to Angola – 2017,
- recapitalization and the new business plan to CGD – 2017,
- conclusion of the selling process of Novo Banco to Lone Star – 2017.

Also, in 2017, the reimbursement profile of the Resolution Fund debt was extended, allowing the Resolution Fund to also extend the period of banks' contributions, thus avoiding a sudden impact to the banking system.

Concerning asset quality, and without prejudice to banks' individual responsibility for managing their NPL portfolio, the authorities – given the systemic nature of the issue - have been working with the banking system on a three-pronged strategy<sup>7</sup>, including (i) legal/judicial, tax and other relevant reforms, (ii) prudential supervisory actions, and (iii) NPL management options. Actions on the legal/judicial dimension include a revamped insolvency procedure with a new player, which can assist debtors in making a diagnosis and prepare restructuring plans; a new legal framework to allow the majority creditors to convert their credit into capital; a new legal framework for voluntary out-of-court settlements; and more expedient insolvency proceedings. Ambitious but realistic workout plans are being prepared by banks with prudential authorities, which are supported by the ability to recognize write-offs and impairments for tax purposes, once these are required from an accounting and regulatory perspective. Banks are expected to take initiative to choose management options more suitable for their strategy. In this context, Caixa Geral de Depósitos, Novo Banco and Millennium BCP are working on a solution for the establishment of a NPL coordination platform aiming at the cooperation of banks in the restructuring of nonperforming companies but that are assessed as economically viable. This work is complemented by initiatives at European level (following the Action plan to tackle non-performing loans in Europe adopted by the Council of the European Union in July 2017) and by authorities' work to improve the capitalization of firms (Capitalizar programme).

### i. The economic impact of stabilization by policy area

The international economic literature is clear about the relevance of a **healthy banking sector** to support economic growth.

On **policies related to bank failure**, Beck (2011) stresses the relevance of imposing market discipline - thus avoiding bail-outs and their effects on banks' risk taking behaviour - while reducing the contagion effects generated by a bank insolvency both on the financial system and on the real economy. Beck et al. (2017) assess credit supply and real sector effects of the resolution of a major bank in Portugal (Banco Espírito Santo, in August 2014), concluding that while banks that were more exposed to the bail-in reduced their credit supply, firms compensated this with alternative sources of financing. Still, heightened uncertainty led firms to increase their cash holdings, reducing investment and employment for the more exposed firms, particularly SMEs. The authors thus argue that well-designed bank resolution frameworks reduce the negative impact of bank failure. Also, it is a key element to effectively breaking the banking-sovereign nexus. Both Acharya et al. (2011) and Candelon and Palm (2010) underscore the contagion of risks from the banking system to the sovereign risk premium during the last financial crisis. Such episodes occur through credit restrictions that have an impact on the economic environment, on the demand for bonds, and also through the State's intervention in the rescue or recapitalization of the banking system, with a subsequent impact on public finance sustainability and on the future tax burden.

Concerning **recapitalization**, according to Jiménez et al. (2012), in a study of the Spanish financial sector, a 1p.p. increase in capital buffers increases credit to firms by 9p.p., thus boosting employment in 6p.p. and increasing firm survival in 1p.p.. Existing empirical studies of the Portuguese experience have shown that public recapitalization contributes to increasing credit supply, especially when the capital buffer of capitalized banks is limited (Augusto and Félix, 2014).

The impact of the **quality of the banks' balance sheet** and of reductions in **non-performing loans** on credit supply can be shown through three mechanisms: an accounting mechanism, whereby higher credit quality affects banks' capital through the weighting of risks; the reduction of financing costs, due to a lower market pressure; and a change in attitude, towards financial institutions (Accornero et al., 2017). As noted by Blanchard and Portugal (2017), there may be gains in sustaining higher deficits to deal with non-performing loans and banks' recapitalization as the impact of the increase in demand in the short-run and of the longer-term effects in supply, due to the stimulus on investment and productivity, more than compensate the initial budgetary impact. Furthermore, the monetary multiplier can contribute to a reduction in the public debt ratio, thus not undermining sustainability. Contributions from Balgova et al. (2016) and Nkuso (2011) for the periods 1997-2014 and 1998-2009, respectively, illustrate the significant impact that changes in the number of defaults have on economic growth. Balgova et al. (2016) indicate that active treatment of NPL is associated with a 3 to 4 percentage points increase in GDP growth (compared to cases of high and persistent NPL) while Nkuso (2011) argues that a 2.4p.p. variation in NPL (a one standard deviation shock in the ratio of non-performing loans to gross loans) has a negative effect on GDP growth in the first year of around 0.6 percentage points, reaching a peak of 1.4 percentage points in the third year. Divanbeigi and Ramalho (2015) show that reforms enhancing the resolution of insolvencies, protecting investors and facilitating credit access are beneficial to long-term growth –

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<sup>7</sup> For a more comprehensive overview of the strategy, see Banco de Portugal, 2017d and 2017e.

the narrowing of the difference between the best and worst quartile of their regulatory indicator is linked to an increase in annual GDP per capita growth of around 0.8 percentage points.

## ii. Overall effects

**Combining all the above effects**, it is clear that a strengthened banking system is key to increasing credit flows - both through greater supply and demand - and to improve the efficiency of capital allocation (Heil, 2017, Aiyar et al., 2015; Kalemli-Ozcan et al., 2015; Hirataka et al, 2013.<sup>8</sup>; Castro et al.,2004). Sobrinho (2017) stresses the contribution of the maintenance of credit capacity to social welfare, avoiding distortions in capital accumulation and promoting technological development. The effects of bank credit are particularly relevant for smaller companies (Beck et al., 2008a; Beck et al., 2008b; Dell’Ariccia et al, 2008), more dependent on bank financing. In a study for Portugal, Farinha et al. (2017) find evidence that access to credit is crucial for the survival of new companies and Amador and Nagengast (2015) highlight its importance to investment, particularly for smaller companies without access to alternative sources of financing. Also for Portugal, Gouveia et al. (2017) find a positive relationship between a strong financial system and firms’ productivity growth, both in the short and long term.

A stable financial system is also important for the implementation of reforms designed to reduce public expenditure. As argued in Brinca et al. (2016) and Spilimbergo et al. (2009)<sup>9</sup>, the decrease in the number of households facing liquidity constraints tends to decrease the magnitude of the fiscal multiplier, since this type of restriction increases the marginal propensity to consume.

Overall, the stability of the financial system is a catalyst for growth. Based on data for 18 OECD countries, including Portugal, over 1980-2008, Monnin and Jokipii (2010) conclude that banking sector stability is an important driver of future GDP growth and periods of stability are generally followed by an increase in real output growth and vice-versa. Furceri and Mourougane (2009) argue that, especially in economies with less flexible labour market institutions, financial crises negatively impact the natural rate of unemployment (NAIRU), due to a hysteresis effect, further reducing potential growth. A solid financial system also promotes inclusive growth (OECD, 2015), potentiates the transmission of monetary policy (Heil, 2017) and reduces the volatility of output, investment and unemployment (Pietrunti, 2017; Abildren, 2016 and Clerc et al., 2016).

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### 3. Resource allocation: tradables and non-tradables

#### **Key messages**

*Given the importance of efficient resource allocation to fostering sustainable economic growth, we shed light on the developments that occurred in the Portuguese economy in the last two decades. The existing literature highlights the build-up of imbalances after the adoption of the euro, associated with a shift of resources to non-tradables. By relying on classification of tradable sectors based on exposure to international competition, we assess the dynamics of three key variables: labour, investment, and gross value added. We show that investment allocated to tradables is on a steady upward trend, while employment and gross value added have kept relatively stable shares across the two sectors. For the three variables, the weight of tradables is broadly in line with that in our European partners.*

Ineffective resource allocation has been portrayed a key factor for the stagnant economic growth of the Portuguese economy in the 2000's and the crisis that followed. Reis (2013), for example, argues that the abundant capital inflows, in the wake of the adoption of the euro, were deployed to relatively unproductive firms in the non-tradable (NTR) sector. This evidence is consistent with the empirical results of Alves and Tavares (2017) that find that Portuguese banks channelled the majority of credit towards less efficient sectors, as well as with that presented in Pina and Abreu (2012), who note that credit and investment were largely targeting sheltered sectors, namely construction and real estate. In the same vein, Marvão Pereira and Pereira (2017) draw attention to large increase in recent decades in the level of investment devoted to infrastructure. Accordingly, infrastructure investment displayed a non-traded bias, shifting the industry mix towards private and public services. Furthermore, the industries that benefit the most in relative terms are all non-traded: construction, trade, and real estate, amongst private services; and education and healthcare, amongst public services.

Low competition in the NTR sector, as a result of policies, market failures or location advantages, tends to favour some firms for reasons other than their economic efficiency (Dias et al., 2014) and results in higher cost-price margins (Amador & Soares, 2014; Folque, 2017). As a result, the rise of the NTR sector at the expense of a relatively more productive tradable (TR) sector caused a fall in productivity and drew resources away from export activities, contributing to the accumulation of external imbalances (Amador & Soares, 2014). Dias et al. (2015) posit that resource misallocation significantly contributed to the poor economic performance in Portugal. The authors show the services sector<sup>10</sup> was the main driver of allocative inefficiencies between 1996 and 2011, with capital distortions being more relevant than labour and output distortions. Reallocation resources towards the most efficient firms would have increased gross output by 17% in 1996 and 28% in 2011.

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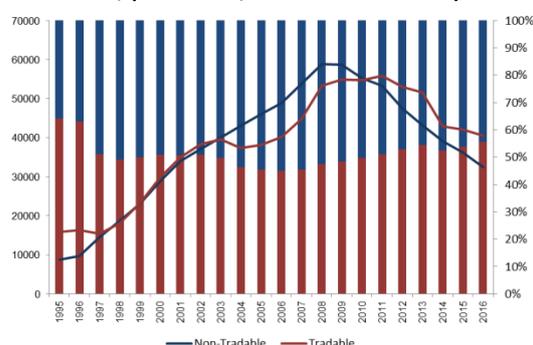
<sup>10</sup> In particular, construction, ground transportation, transportation support services, general support services and wholesale of food, beverage and tobacco.

Banco de Portugal (2017) notes that the positive export dynamics that define the 2009-2016 period, with the weight of exports in GDP (nominal terms) increasing by 13p.p., is linked to the reorientation of economic resources to the TR sector. This is considered a structural feature in that it is “based on a business restructuring that began before the international financial crisis” (Banco de Portugal, 2016).

Taking the allocation of credit as a proxy of resource allocation, one sees that the shares of TR and NTR sectors were fairly similar until 2003, with the stock of credit increasing in both sectors (Figure 11). However, the slowdown in the TR sector in the mid-2000s rendered a higher relevance to the NTR sector, which was only reversed from 2010 onwards. Nowadays, tradables account for 56% of all credit granted, an increase of 11p.p. vis-à-vis 2006 (the lowest point in the series)<sup>11</sup>. There are two sectors that largely explain these changes: construction (NACE F) and, to a lower extent, real estate activities (NACE L) (Figure 12). Indeed, exporting firms and those with better risk profiles were less affected by credit shortages and returned faster to positive growth rates (Banco de Portugal, 2017b and Banco de Portugal, 2017c).

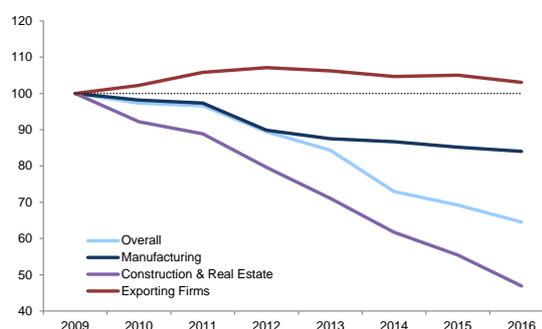
We now turn to the methodology developed by Canas and Gouveia (2016)<sup>12</sup> to look in greater detail into the allocations of resources between tradables and non-tradables. We concentrate on market output, excluding the public sector from the analysis. We focus on three key variables: employment, investment and gross value added. The results suggest that investment in tradables is on a steady upward trend, accounting now for around 60% of the total investment. Employment and gross value added have more stable shares (70% and 60%, respectively), broadly in line with those of our European partners.

**Figure 11 - Evolution of the stock of credit, 1995-2016, (€M – lines; and % of total - bars)<sup>13</sup>**



Source: Authors’ own computations based on Bank of Portugal; Methodology: FIPEI, excluding the public sector (see Box 3 for further details).

**Figure 12 - Credit to NFC (stock), (2009=100)**



Source: Bank of Portugal

<sup>11</sup> See, also, Martins et al., 2017.

<sup>12</sup> See Box 3 for further details.

<sup>13</sup> Data do not include securities. The disaggregation by sector has some constraints: i) the Financial and insurance activities sector (NACE K) only includes non-financial holdings; ii) Electricity, gas, steam and air conditioning (NACE D) and Water and waste (NACE E) are not disaggregated and were both considered as tradables (according to a different database that allows the disaggregation of these two sectors, the ratio of credit absorbed by D sector was 64% on average between (2003 and 2016). Based on this, and given the fact that the two sectors together account for between 3 and 5% of the total credit, the real share of TR sector is likely to be 1 to 2p.p. lower than the values presented in the figure 11) iii) values for NACEs R-U are aggregated with the public sector and thus are not considered in these credit aggregated.

### Box 3 – Methodology to define tradable and non-tradable sectors

Our analysis follows the tradable/non-tradable classification suggested by Canas and Gouveia (2016). As stated by the authors “To date, economic assessment reports produced by international institutions usually use one of two criteria: the static rule-of-thumb of considering the manufacturing sector as the only tradable sector – a criterion that is becoming more obsolete as technological progress decisively unleashes the tradable potential of service sectors; or a dynamic (yet partial) evidence-based criterion that uses export data (namely, the export-to-output ratio) to determine a sector’s tradability – defining tradable sectors as (solely) exporting ones.”

Canas and Gouveia (2016) “build on this second approach and classify a sector as tradable if part of its final output is either exported or imported. Indeed, one looks at tradability with the goal of identifying sectors that are exposed to international competition – this may be the case for an exporting company when competing in external markets but also for a company operating in the domestic market but facing the competition of external firms. Therefore, this extension, which entails significant computational challenges, allows for a given sector that is not an exporter to be classified as tradable as long as other countries are exporting the same kind of products to the country.”

By numerically capturing the tradability of each sector, the new criterion (henceforth the FiPEI criteria) “closes a gap in the methodology that has been repeatedly identified by both previous authors and international institutions, while guaranteeing the criterion’s parsimony in application and hence its policy suitability.”

In this setting, the following modified trade-to-output ratio (TOR) is computed for each sector, based on imports and exports data by type of product (after a matching of import data).

$$TOR = \frac{imports + exports}{gross\ value\ added}$$

A sector is classified as tradable when its TOR exceeds 10%. The allocation of sectors resulting for the application of this method is presented in Table A1. The authors do not classify sectors O to S, given the lack of disaggregated data. As our analysis excludes the public sector, sectors O and Q are not considered. Regarding sectors R and S, our hypothesis is that the type of services provided are similar to the ones of sector I. In any case, the weight of these two sectors in the variables analysed is negligible.

**Table A1: Different tradable/non-tradable classifications**

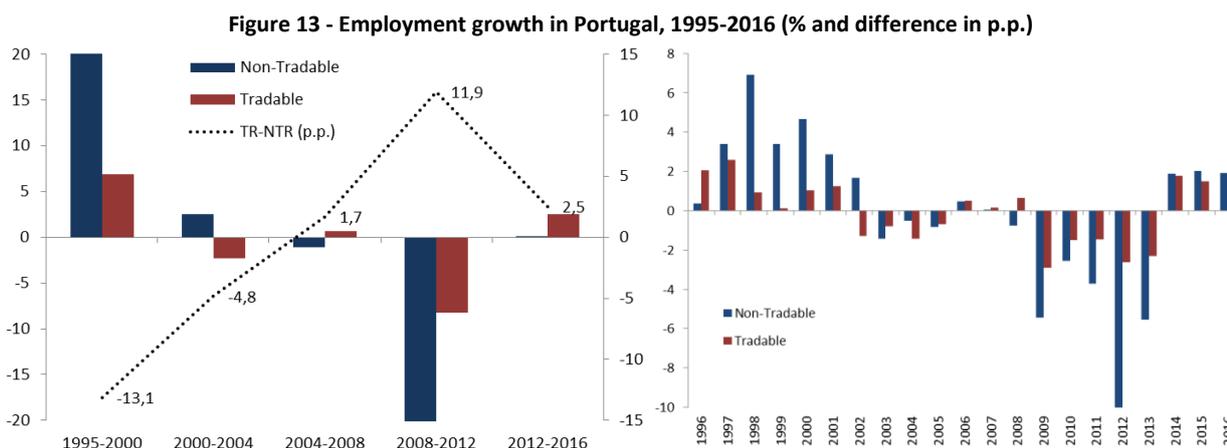
	Sector designation in NACE Rev.2/Criteria	IMF	AMECO	FiPEI	Our analysis
A	Agriculture, forestry and fishing	NTR	TR	TR	TR
B	Mining and quarrying	TR	TR	TR	TR
C	Manufacturing	TR	TR	TR	TR
D	Electricity, gas, steam and air conditioning supply	NTR	TR	TR	TR
E	Water supply; sewerage, waste management and remediation activities	NTR	TR	NTR	NTR
F	Construction	NTR	NTR	NTR	NTR
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	NTR	TR	NTR	NTR
H	Transportation and storage	NTR	TR	TR	TR
I	Accommodation and food service activities	NTR	TR	TR	TR
J	Information and communication	NTR	TR	TR	TR
K	Financial and insurance activities	NTR	NTR	TR	TR
L	Real estate activities	NTR	NTR	NTR	NTR
M	Professional, scientific and technical activities	NTR	TR	TR	TR
N	Administrative and support service activities	NTR	TR	TR	TR

O	Public administration and defence; compulsory social security	NTR	NTR	(1)	-
P	Education	NTR	NTR	(1)	-
Q	Human health and social work activities	NTR	NTR	(1)	-
R	Arts, entertainment and recreation	NTR	TR	(1)	TR
S	Other service activities	NTR	TR	(1)	TR

### Labour Allocation

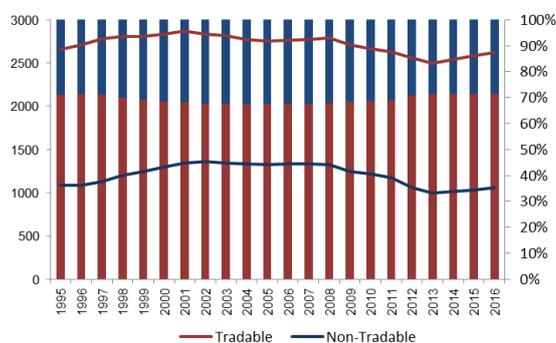
From 1995 to 2004 (Figure 13) the number of jobs in the NTR sector experienced a significant increase (23%), much higher than growth in the TR sector (4.5%). From 2004 onwards this pattern changed. The decline in the number of jobs intensified in the non-tradables, which were more affected by the crisis. Despite higher growth of TR employment in the most recent period of our analysis (2012-2016), in the last three years NTR sector employment started growing and at a slightly higher pace.

All these developments translated into a distribution of employment within TR and NTR sectors for 2016 similar to the one registered in 1995, with 71% of the employment being in the TR sector (Figure 14). A similar pattern can be found in the EU28, where the TR sector also accounts for 70% of employment.



Source: Authors' own computations based on Eurostat; Methodology: FIPEI, excluding the public sector

**Figure 14 - Evolution of employment, 1995-2016 (thousand persons – line; and % of total - bars)**

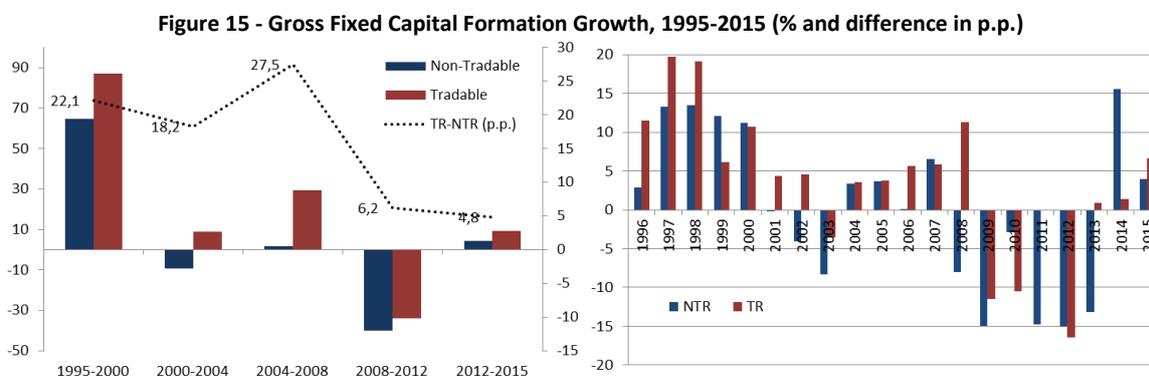


Source: Authors' own computations based on Eurostat; Methodology: FIPEI, excluding the public sector

### Capital Allocation: Investment – Gross Fixed Capital Formation (GFCF)

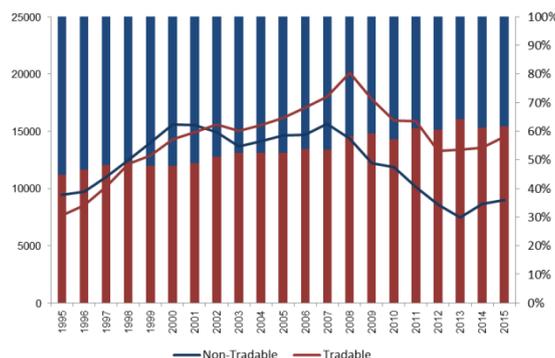
Before the economic crisis, investment in the TR sector grew faster than in the NTR sector (Figure 15). From 2008 onwards, investment reduced in both sectors as a result of the crisis, but the TR

sector was less affected and recovered more rapidly in the post-crisis period. In fact, and despite some annual oscillations in the flows<sup>14</sup>, the growth rate of investment directed to TR sectors has been consistently higher than the one for NTR sectors in the last two decades. This reallocation process led investment in the TR sector to surpass that of the NTR sector in 2002, remaining higher ever since. All in all, grew from around 50% in 1995 to close to 60% in 2015 (Figure 16), which is similar to other European countries<sup>15</sup>.



Source: Authors' own computations based on Eurostat; Methodology: FIPEI, excluding the public sector

**Figure 16 - Evolution of GFCF, 1995-2016, (€M – lines; and % of total - bars)**



Source: Authors' own computations based on Eurostat; Methodology: FIPEI, excluding the public sector

### Output – Gross Value Added<sup>16</sup>

The NTR sector consistently recorded higher gross value added (GVA) growth rates before the crisis and was less affected by it. Yet, in the most recent years (2012-2015), there appears to have been a shift towards higher growth in the TR sector (12%, which compares with 7% in the NTR sector) (Figure 17). Despite these positive recent developments, the share of the TRD sector on total GVA is still below 1995 values (60% vs. 63%) (Figure 18) but is broadly in line with the share in the EU<sup>17,18</sup>.

<sup>14</sup> For instance, in 2014 there was a strong growth of NTR sector (16%) while the TR sector grew only 1.4%.

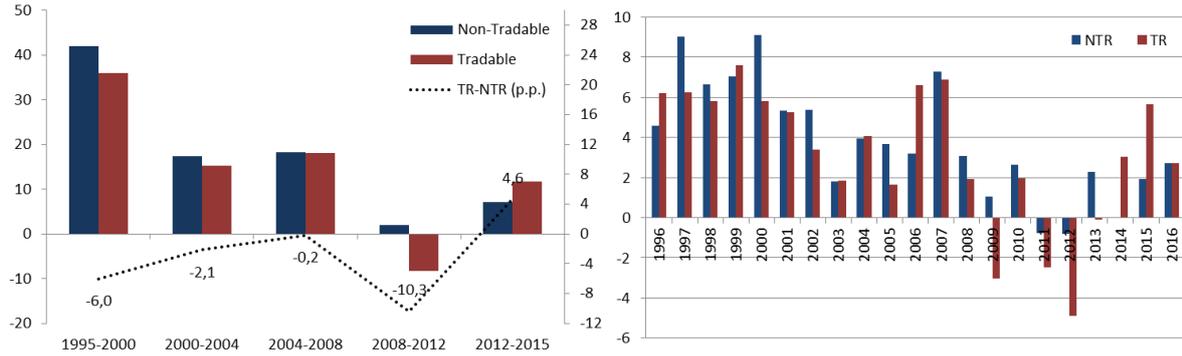
<sup>15</sup> For instance, Germany, Spain and Italy had shares of investment in TR sectors between 50% and 60%.

<sup>16</sup> For an overview of GVA developments in Portugal, please refer to Box 4.

<sup>17</sup> The analysis for the EU does not include the sector of Professional, scientific and technical activities (NACE M).

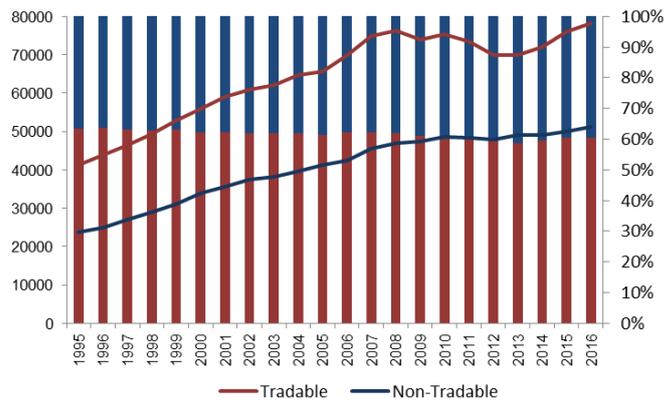
<sup>18</sup> Given the lack of available data, the period considered in this comparison is 2000-2014.

**Figure 17 - Growth of Gross Value Added (GVA) in Portugal, 1995-2016 (% and difference in p.p.)**



Source: Authors' own computations based on Eurostat; Methodology: FIPEI, excluding the public sector

**Figure 18 - Evolution of GVA, 1995-2016 (€M and % of total)**



Source: Authors' own computations based on Eurostat; Methodology: FIPEI, excluding the public sector

#### Box 4 – A deeper look at GVA developments

In this Box, we focus on GVA growth, decomposing it into productivity and labour developments. We further decompose the effect of labour into actual labour market dynamics (i.e. those related with the participation rate) and those that result from demographic developments (i.e. linked with changes in the working age population)<sup>19</sup>.

$$GVA_t = Productivity_t \times Emp. Rate_t \times Working\ age\ pop._t$$

Thus, it is possible to decompose GVA growth into three effects:

- Productivity effect: changes in productivity;
- Employment rate effect: changes in labour market participation;
- Working-age population effect: population growth<sup>20</sup>.

Figure 4.1 shows that the demographic effect is positive but modest. Indeed, the growth rates of the

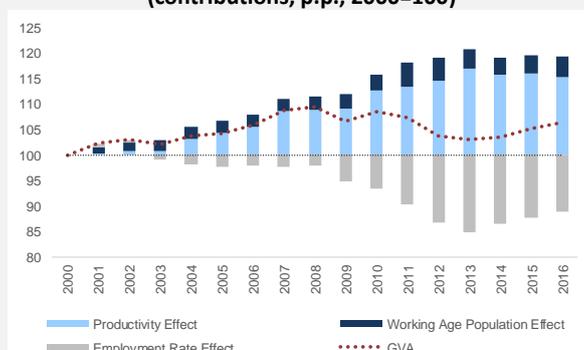
<sup>19</sup> This entails a small methodological caveat. Productivity is calculated with data from the National Accounts. However, National Accounts do not have data on working age population or participation rate. Thus, in order to ensure the coherence of the results, we calculate the employment rate using data from the Labour Force Survey, and use these results to compute the working-age population compatible with the employment from the National Accounts. This should not distort the results in a meaningful way as the Y-o-Y change rates of employment in the Labour Force Survey and National Accounts are very similar.

<sup>20</sup> Removing this effect, we would get an approximation of the growth of per capita GVA.

working-age population have been declining, even becoming negative after 2011 (Figure 4.2).

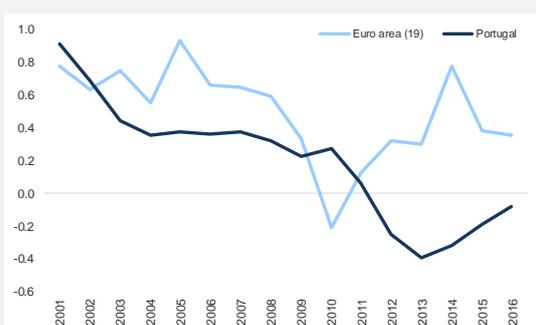
The employment rate effect is historically negative and started to act as an important drag on growth from 2009 onwards. Its negative contribution is still considerable, but is being reduced since 2013, when the employment rate recovered slightly (Figure 4.3).

**Figure 4.1 – GVA growth decomposition  
(contributions, p.p., 2000=100)**



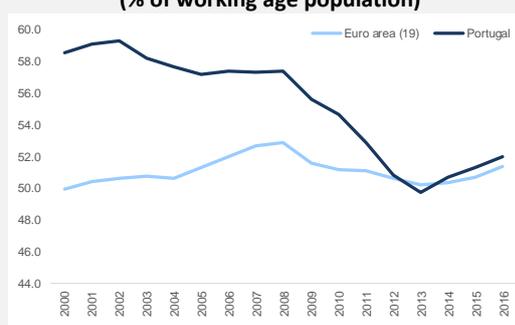
Source: Eurostat, Statistics Portugal, authors calculations.

**Figure 4.2 – Working age population (Y-o-Y, %)**



Source: Eurostat (Labour Force Survey).

**Figure 4.3 – Employment rate  
(% of working age population)**

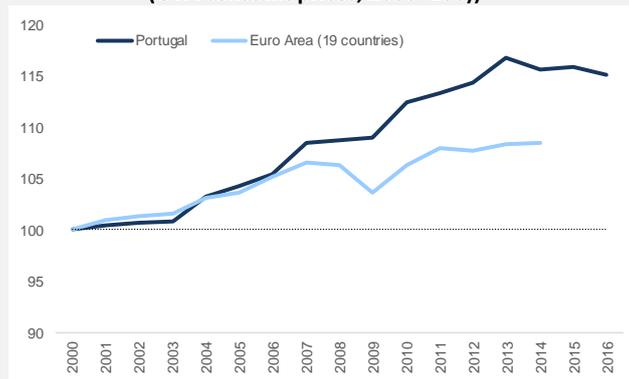


Source: Eurostat (Labour Force Survey).

The contribution of productivity developments (GVA per person employed) is positive, broadly increasing every year from 2000 to 2013 and having stabilized after that. These positive developments are particularly important if compared with those in the euro area (Figure 4.4). In fact, whilst until 2006 Portugal evolved in tandem with the euro area average, after this period the evolution in Portugal is more positive, with a growing positive gap. Data shows that while Productivity has grown, on average, 0.9% and 0.8% in Portugal and in the EA, respectively, from 2007 to 2014 these rates have climbed to 1.2% in Portugal and decelerated to 0.4% in the EA.

It is especially interesting to stress the period of 2009, after the onset of the financial crisis, during which the productivity in the euro area contracted quite significantly. This behaviour contrasts with the evolution in Portugal, for which productivity remained rather stable (even registering a slight increase), better weathering the shock. The drop in productivity in the EA resulted from a sharp decrease on GVA (4.5%), which was partially offset by a decrease on employment (-2%). In Portugal, employment was also decreasing, but GVA did not drop as much, which resulted in slight gains. More recently, productivity in Portugal has stabilized, even registering a slight decrease since 2013 (-1.4% between 2013 and 2016). This results from the increases in employment (4.8%) more than offsetting the increases in GVA (3.3%), mirroring the effects that occurred during the crisis period.

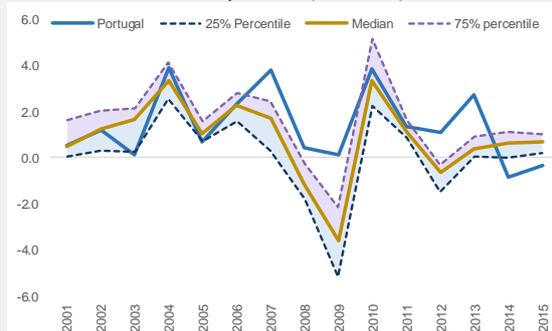
**Figure 4.4 – Productivity developments  
(GVA constant prices, 2000=100)**



Source: Eurostat.

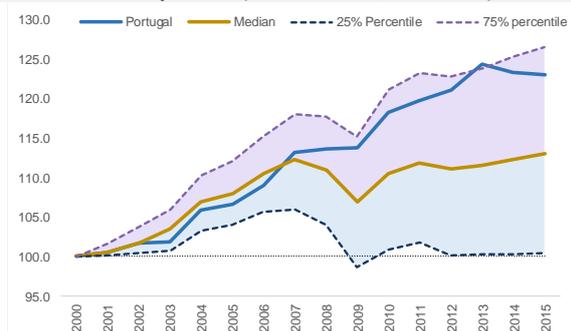
Given the evidence in Figure 4.4, it is important to further assess where Portugal stands when compared with its peers, moving beyond the EA average. For this exercise, we use the data from EU KLEMS. These data covers the sectors belonging to the Market Economy, allowing for a better international comparison of economies, as it only considers those that are more directly exposed to external competition and as such, in which productivity developments matter the most. The sample considered consists of 14 countries, most of which belonging to the EA<sup>21</sup>. The analysis is carried out by computing the 25% percentile, 75% percentile and median of the productivity growth rate and comparing it to the developments registered in Portugal.

**Figure 4.5 – International comparison of productivity developments (Y-o-Y, %)**



Source: EU KLEMS and authors' own calculations.

**Figure 4.6 – International comparison of productivity developments (accumulated, 2000=100)**



Source: EU KLEMS and authors' own calculations. Note: Accumulated intervals calculated considering the growth rates from Figure 4.5.

Figure 4.5 shows that developments of productivity in Portugal have been overall positive when compared to those of its peers. More specifically, productivity in Portugal has not declined during the crisis period (growth has been near 0%, but never negative). Additionally, the average productivity growth in Portugal (1.4%) is significantly higher than the average growth rate of the median (0.8%). When compared to the 75% percentile, Portugal is only slightly below it (1.6% and 1.4%, for the 75% percentile and Portugal, respectively).

The accumulated figures (Figure 4.6) reinforce this positive assessment, with Portugal overtaking the median in 2007 and shortly standing above the 75% percentile in 2013. Since 2013, however, we witness a decline of Productivity in Portugal, while both the Median and 75% percentile have climbed. In any case, Portugal is still located in the upper part of the distribution.

<sup>21</sup> More specifically, the sample considers the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Portugal, Spain, Sweden, the Netherlands, the United Kingdom and the United States of America.

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## 4. A glimpse at zombie firms

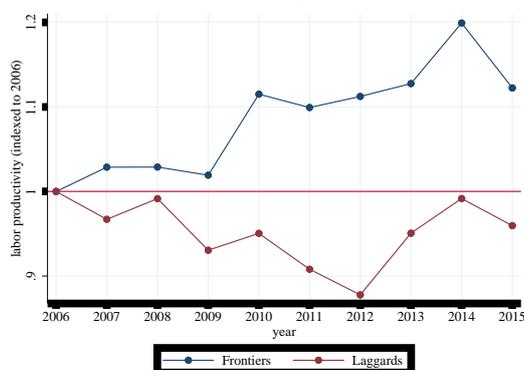
This is a summary version of the forthcoming article Osterhold, C. and A. Fontoura Gouveia (2018), "Should we fear the walking dead? The role of zombie firms", GPEARI Working Paper, January 2018.

### Key messages

Firm-level data offers important insights on the so-called productivity paradox (i.e. the fact that Productivity growth is slowing down amid rapid technological progress and ever more educated labour force), by pointing at the divergence between the most productive firms (those at the frontier) and all the others (the laggards). Among several explanations, the increased prevalence of zombie firms – those that should leave the market under properly functioning economies – has been put forward by the OECD as a possible driver. By relying on a rich set of firm-level data for Portugal, we show that the share of zombie firms has indeed increased up to 2013, but is now on a downward trend. Our analysis also shows that capital and labour sunk in these firms is significant (22% and 15%, respectively), harming the performance of all firms. Finally, by relying on an exit model, we claim that the changes in the insolvency framework enacted in recent years foster the exit of zombie firms, with overall gains for the economy.

Productivity is slowing down among OECD countries. The growing use of firm-level data in empirical analyses allowed uncovering asymmetric firm-level dynamics. In Portugal, as in other OECD countries, there is a growing gap between the labour productivity of the most productive firms (those at the frontier) and the other firms, the so-called laggards (Figure 19).<sup>22</sup>

Figure 19 - Labour productivity developments in Portugal from 2006 to 2015: frontier vs. laggard firms



Source: Authors' own computations based on IES.

Several explanations have been put forward in the literature, namely a breakdown in the diffusion mechanism (McGowan et al., 2017b), rising resource misallocation (Gopinath et al., 2017) or declining firm entry (Decker et al., 2016). A recent strand of literature, led by the OECD, is focusing on the role of zombie firms (McGowan et al., 2017a) that, by capturing resources into unproductive activities, drag aggregate productivity down. This latter approach is the focus of our analysis.

<sup>22</sup> The frontier is defined as the top 10 % most productive firms in each two-digit sector industry in each year. The overall results are robust, when defining the frontier as the top 5 %. Labour productivity is defined as Gross Value Added (GVA) per worked hour. Results are robust when using the number of workers.

We rely on firm-level data for the period 2006 to 2015, obtained from Informação Empresarial Simplificada (IES) provided by Banco de Portugal. The data used covers the non-farm and the non-financial business industries, NACE industry codes (10-83, excluding 64-66). Self-employed and inactive businesses have been dropped and values have been deflated by industry-specific deflators. Negative, missing and nil values for variables turnover, assets, intangibles and tangible assets, total workers, paid workers, worked hours and labour costs have been dropped. Assumptions of feasible working hours and viable revenues have been made to account for outliers and misreporting. One year reporting gaps have been interpolated linearly.

#### **i. Zombie firms in Portugal**

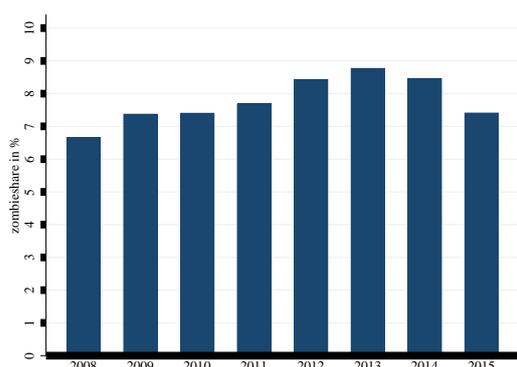
Following McGowan et al. (2017a), we define zombie firms as those that are at least ten years old (not to capture start-ups which are in a developing phase) and whose operating income cannot cover the interest payments for at least three consecutive years.

According to our estimates, the share of zombie firms (number of zombie firms / total number of firms) increased steadily until 2013 (9%) but it started declining afterwards, reaching 7.5% in 2015 (Figure 20). These results hide considerable sectoral heterogeneity (Figure 21): the zombie share ranges from 3% in professional, scientific and technical activities to 13% for the accommodation and food service industry. In terms of international comparisons, the overall value for Portugal in 2013, the latest year available in McGowan et al (2017a), is above the average for the sub-set of countries considered in the OECD study (Belgium, Finland, France, Italy, Korea, Spain, Sweden and the United Kingdom).

On average, zombie firms in Portugal are older, larger (both in terms of number of employees and turnover) and are much less productive than their non-zombie counterparts. Therefore, and also in line with the results of McGowan et al. (2017), the share of employment and capital sunk in zombie firms is significantly higher than their share in the total number of firms, with zombies absorbing almost 15% of total employment (Figure 22) and 22% of capital (Figure 23) in 2015. Although still high, also in comparison with the sub-set of OECD countries, the latest figures are improvements vis-à-vis 2013 data, with reductions of more than 2p.p. in terms of employment and of close to 5p.p. for capital. This is of particular relevance given that, as shown in the econometric analysis in Osterhold and Gouveia (2018), a reduction of capital sunk in zombies brings positive externalities to non-zombies.

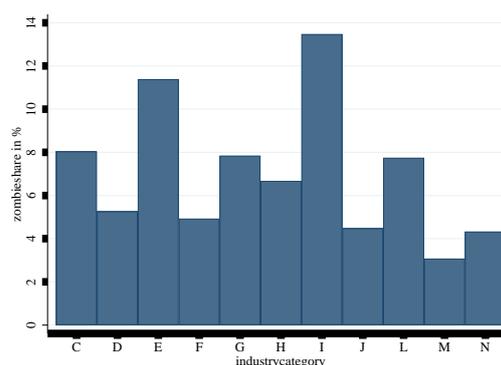
Recent work by the OECD highlights the role of public policy in fostering a better resource allocation – namely in terms of insolvency procedures (Adalet McGowan et al., 2017b) and in addressing bank health and non-performing loans (Andrews and Petroulakis, 2017). In Osterhold and Gouveia (2018) we show that the recent measures to improve insolvency procedures in Portugal do indeed potentiate the exit of zombies, in line with their intended outcome.

**Figure 20 - Percentage of zombie firms compared to all firms, 2008 to 2015**



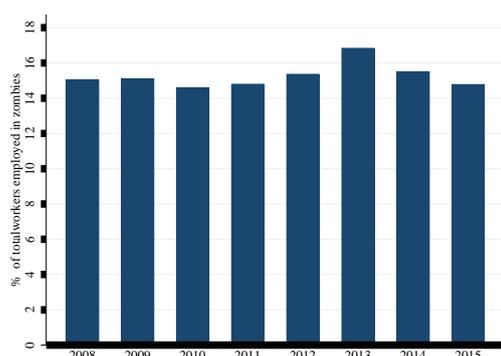
Source: Authors' own computations based on IES.  
 Note: The chart displays the number of zombie firms as a share of the number of all firms.

**Figure 21 - Share of zombie firms in different industry categories in 2015**



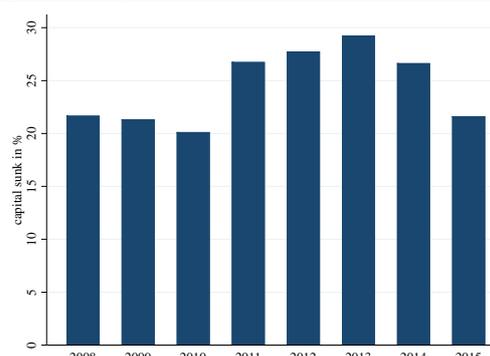
Source: Authors' own computations based on IES.  
 Note: C - manufacturing, D - electricity, gas, steam and air conditioning supply, E - water supply, sewerage, waste management and remediation, F - construction, G - wholesale and retail trade, repair of motor vehicles and motorcycles, H - transportation and storage, I - accommodation and food service activities, J - information and communication, L - real estate activities, M - professional, scientific and technical activities, N - administrative and support service activities

**Figure 22 - Labour sunk in zombie firms, 2008 to 2015**



Source: Authors' own computations based on IES.  
 Note: The chart displays the percentage of total workers employed in zombie firms as a share of total workers.

**Figure 23 - Capital sunk in zombie firms, 2008 to 2015**



Source: Authors' own computations based on IES.  
 Note: The chart displays the share of tangible capital in zombie firms (as a fraction of total tangible capital).

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## 5. TFP à la carte?

### **Key messages**

*TFP is often computed as a residual of a production function, and therefore the results are influenced by the choice of the functional form, the definition and measurement of outputs and inputs and the estimation algorithm. This chapter reviews the literature on TFP estimation methods, highlighting their important limitations and their high sensitivity to estimation methods. Using TFP data from different databases, such as AMECO, OECD and Penn World Table, we show that methodological choices and assumptions lead to vastly different TFP estimates, with differences in TFP growth rates reaching more than 1 percentage point. We propose more granular approaches to the estimation of TFP as a way of moving forward.*

Total Factor Productivity (TFP) “reflects the overall efficiency with which labour and capital inputs are used together in the production process” (OECD, 2017). Changes in TFP can then result from changes in “management practices, brand names, organizational change, general knowledge, network effects, spillovers from production factors, adjustment costs, economies of scale, the effects of imperfect competition and measurement errors.” In practice, the general approach to estimating TFP consists in choosing a functional form that expresses the relationship between inputs and outputs, and computing TFP from the residual.

#### **i. The production function**

An important implication of the methodology is that TFP can only be retrieved if production is accurately described by the function that is used. In practice, TFP is usually estimated considering a homogenous good or service produced using specific proportions of materials and factors, namely homogeneous labour and capital.

These are strong simplifications. Firms rely on different types of capital, with different marginal productivities, that cannot be aggregated. The problem is particularly acute at the aggregate level, leading to higher misspecification of the functional form (for an overview of the main issues, please refer to Temple, 2006 and Felipe and Fisher, 2003). If firms produce differentiated goods and services, with different shares and marginal productivity for the various inputs, a new functional form is required. This implies aggregating production functions for each output, which is mathematically unfeasible (Temple, 2006).

In the literature, the most popular specifications for the production function are Cobb-Douglas, Constant Elasticity of Substitution (CES) and Translog functions, with two inputs – capital and labour. There is no consensus on what is the best specification and all have important limitations (Felipe and McCombie, 2014). As shown in Felipe (1999), a misspecification of the functional formula tends to generate unreliable results.

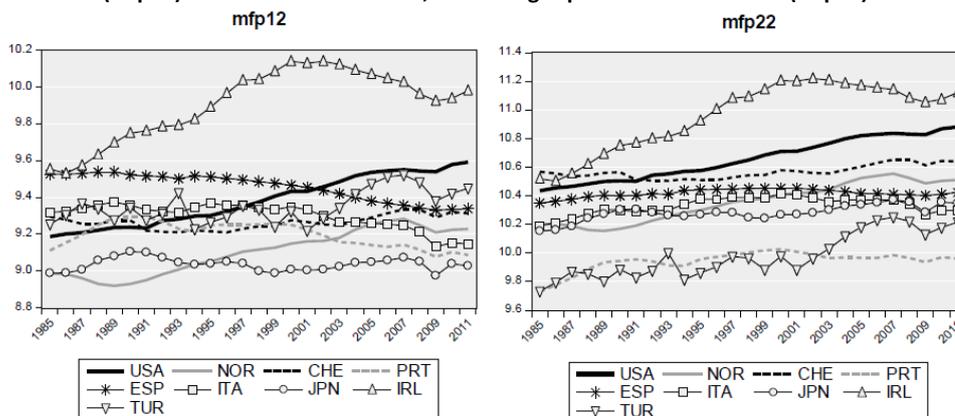
Notwithstanding these limitations, a common justification for the use of such an approach is that it holds empirically. It has been claimed, however, that the empirical evidence is essentially capturing the effects of an accounting identity which relates income with labour’s compensation and profits, which is a direct consequence of the use of deflated values instead of quantities (Felipe and Fisher, 2003; Felipe and McCombie, 2006). This would also explain why production functions also fit the data even when the generating process does not correspond to the functional form that is assumed.

## ii. Measurement issues

Apart from the specification of the production function, TFP estimates are also influenced by the proxies chosen to measure inputs and output, with important implications for the final results (OECD, 2001; Égert, 2017).

A standard approach to measuring labour involves assuming homogeneity of the labour force and focusing on hours of work or number of employees (OECD, 2001 and 2017). Other approaches take into account different types of labour, using number of years of education as a proxy for skills (Caselli, 2005; Hall and Jones, 1999; Delgado et al., 2012), or including a measure of management performance (Bloom et al., 2006, 2016). Égert (2017) shows that the decision to include or exclude human capital as an input in the estimation procedure has a significant impact on both the level and the dynamics of TFP<sup>23</sup>. In particular, when only a quantity measure of human capital (mean years of schooling) is allowed for, the estimates of TFP are implausible as several countries, such as Spain, Italy and Portugal have very short periods of TFP growth (or none in the case of Spain), and prolonged reductions in recent years. If human capital is captured in the residual instead, relative levels and trends of TFP estimates become more plausible, with larger periods of growth and both smaller and shorter reductions for the three countries (Figure 24). This highlights measurement issues in the human capital input estimates, as mean years of schooling are not an adequate measure of human capital. They fail to account for quality of education thus hampering a proper cross country comparison. As there is only limited correlation between quantity and quality of education, the resulting estimated of TFP are biased and not comparable.

**Figure 24 - TFP estimates when human capital measured as mean years of schooling is included as input (mfp12) and when it is excluded, thus being captured in the residual (mfp22)**



Source: Égert (2017).

There are also various methods that have been used to measure capital, such as the perpetual inventory method or the book value of the capital stock. The former cumulates flow data and are therefore highly sensitive to the assumptions and values used for deflators, depreciation and deterioration rates, the initial value of the capital stock and choice of asset disaggregation (OECD, 2009a,b). Book values are also affected by the choice of the rates of depreciation and deterioration. Furthermore, in the absence of firm-specific deflators, they rely on aggregate or industry-level deflators, which are a poor approximation of firm-level data (Van Beveren, 2012; Syverson, 2011).

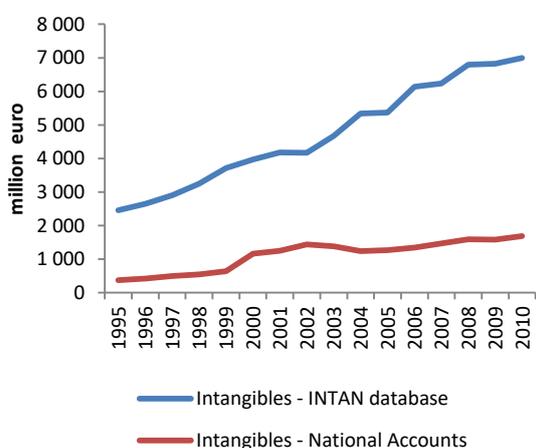
Another issue with the measurement of the capital stock is related to the measurement of intangibles (OECD, 2009b, 2017). National accounts do not include several types of intangible assets, such as new

<sup>23</sup> As TFP is computed as the residual, whatever is not captured by the input measures is included in the TFP measure.

products or design of new products, advertising and market research, employer-provided training and organizational structure (Corrado et al., 2012). The exclusion of these assets has a sizeable impact on the measure of capital stock (Figure 25) and thus leads to biased estimates of TFP growth. Furthermore, in firm-level databases, the quality of reported values of intangibles is usually low, with a large proportion of firms reporting missing values. Besides the choice of the methodology for the measurement of the capital stock, the distinction between quantity and quality effects of capital may also be relevant (Banco de Portugal, 2017).

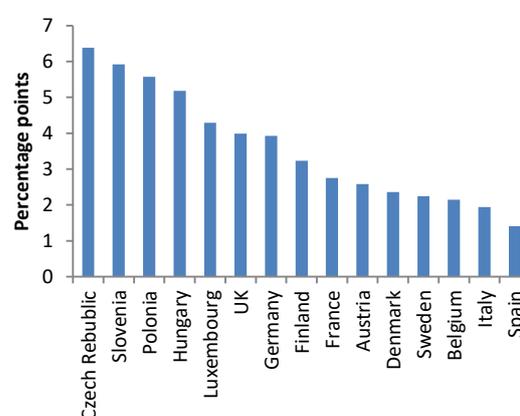
With regards to the measurement of output, there are two widely used measures, namely value added and gross output. The latter allows for intermediate consumption in the production function. The estimates based on the two measures should be similar. Yet, in practice, this is not the case, with absolute differences ranging from 1.5pp in Spain to more than 6pp in Slovenia and Czech Republic (Figure 26).

**Figure 25 - Intangible estimates from national accounts and from INTAN Invest database**



Source: INTAN Invest database. INTAN-Invest database is a product of 'research collaboration dedicated to improving the measurement and analysis of intangible assets. It disseminates harmonized cross country data on intangible investment'.

**Figure 26 - Average of the absolute difference between TFP growth rates computed using different measures of output: value-added and gross output (1996-2004)**



Source: Authors' computations based on EU KLEMS<sup>24</sup> data  
 Note: The values presented are the average, across years and industries, of the absolute difference between TFP growth rates computed using value-added and gross output as the measure of output.

Finally, to make the results comparable across countries, output and capital are often computed using Purchasing Power Parities (PPPs). The choice of the methodology used to calculate PPPs, however, has a significant impact on the level and change of TFP (Égert, 2017)<sup>25</sup>.

<sup>24</sup> The EU-KLEMS database is a result of a project aimed at creating a database that included harmonized measures of productivity, employment, capital formation, technological change and economic growth at the industry level for the European Union members (the indicators are not reported for all countries when there is insufficient information on required indicators). It releases productivity estimates for the total economy and for 34 industries, using the value added approach and KLEMS approach (which uses gross output and capital, labour, energy, materials and service inputs). The initiative is financed by the European Commission, Directorate-General for Economic and Financial Affairs.

<sup>25</sup> Égert (2017) provides empirical evidence of the different estimates of TFP obtained when using different measures of PPPs for OECD countries.

### iii. Estimation issues

On top of all of the difficulties mentioned above, there are also important problems related to the estimation approach, as there is no consensus in the literature regarding the preferred method. In general, TFP is estimated using a deterministic, parametric or semiparametric approach, using micro or macro data (Del Gatto et al., 2011). The most popular models are index formulas, in particular, the Törnqvist index, Data Envelopment Analysis (DEA), Stochastic Frontier Approach (SFA), GMM or semi-parametric approaches, such as the ones developed by Olley and Pakes (1996) or Levinsohn and Petrin (2003). All of them have important implications for the final estimates, leading to very different results (Van Biesebroeck, 2007, Coelli et al., 2005, Van Beveren, 2012).<sup>26</sup>

Moreover, the estimates incorporate several assumptions that are unlikely to be observed and that impact the results. Examples of these assumptions are (i) technical efficiency (as pointed by Amador and Coimbra, 2007; Green, 2008; Kumbhakar et al., 2000; Aigner et al. 1977; frontier models address this problem but are demanding in terms of available data – see, for instance, Del Gatto et al., 2012 and Van Biesebroeck, 2007); (ii) full capacity utilization (most studies do not control for differences in the capacity of utilization of factors, especially capital, and this misspecification can add a cyclical component to the residual (OECD, 2001)); (iii) the existence of a representative firm (Temple, 2006); (iv) efficient allocation of inputs (Dias et al., 2016; Adler et al., 2017); (v) constant returns to scale (Del Gatto et al., 2011), (vi) stochastic element following a specific distribution in SFA (Coelli et al., 2005), (vii) exogenous inputs (Van Beveren, 2012), (viii) strictly positive investment that is increasing in productivity (Levinsohn and Petrin, 2003; ABBP, 2007), and (ix) deflators able of removing the price effect (Van Beveren, 2012; Syverson, 2011).<sup>27</sup>

### iv. Conclusion

TFP is described as the portion of output not explained by a number of inputs used in production and is often computed as a residual. The main issue associated with this approach is that TFP can only be estimated if the production technology is properly described by a production function. Therefore, the choice of the functional form, definition and measurement of outputs and inputs and the estimation algorithm will influence the results.

At the moment, there is no evidence in the literature that the production technology can be accurately described by a production function, that adequate information regarding input quantities and output is available or possible to compute and there is also no evidence on which method is superior to compute TFP. Different choices concerning these elements lead to very different estimates of TFP growth – sometimes even qualitatively different, i.e. with different signs – thus limiting their usefulness for policy makers (Figure 27). As showed by Égert (2017), measurement problems on inputs may lead to counterintuitive relative levels and trends of TFP.

Finally, there is evidence of increasing heterogeneity of productivity dynamics across firms, calling for the need to use disaggregated data in policy applications. Recent studies suggest that lower productivity growth at the aggregate level is related to increased heterogeneity of productivity developments at the firm level (OECD, 2016), linked to factors such as structural changes in the

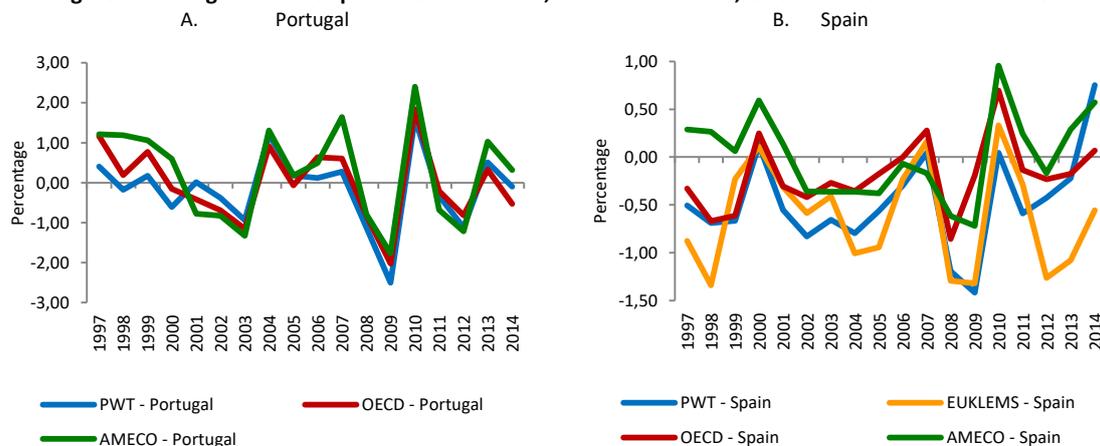
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<sup>26</sup> Further information on the description of the different methods is available in Annex A.

<sup>27</sup> Further information on the issues specific to each model is available in Annex B.

production process (e.g. McGowan et al., 2017) and heterogeneity of management practices (e.g. Lewis, 2004).

**Figure 27 - TFP growth rates published in AMECO, Penn World Table, OECD and EU KLEMS database**



Source: Authors' computations based on OECD, EU KLEMS, PWT 9.0 and AMECO data. Further information on each model is available in Annex C.

Note: EU KLEMS data only available for Spain.

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## Annex A

Estimation algorithm	Description	References
Index numbers	<ul style="list-style-type: none"> <li>It follows a nonparametric approach. There are three main types of index numbers that are used - profit ratios, Malmquist indexes or ratio output-input.</li> <li>The most widely used are the ratio output-input, which consists of a ratio of a quantity output index over a quantity input index. Its quantity indices can be computed with different formulas, such as Laspeyres, Paasche, Fisher, and Törnqvist that aggregate the different outputs or inputs. The last two, Fisher and Törnqvist indices are considered superlative indices.</li> <li>The Törnqvist index is by far the most popular index and it is used to compute TFP indices published in PWT, OECD, EU KLEMS:</li> </ul> $\ln TFP_{st} = \ln \frac{\text{output index}_{st}}{\text{input index}_{st}} = \ln \text{output index}_{st} - \ln \text{input index}_{st} = \frac{1}{2} \sum_{m=1}^m (r_{is} + r_{it})(\ln q_{mt} - \ln q_{ms}) - \frac{1}{2} \sum_{n=1}^N (u_{ns} + u_{nt})(\ln x_{nt} - \ln x_{ns})$ <p>Where s,t stand for the 2 periods, there are m outputs and n inputs, which are weighted by cost shares r and u.</p> <ul style="list-style-type: none"> <li>Other indices are also used; the European Commission calculates TFP as a residual of a Cobb-Douglas production function with labour and capital inputs measured at their full capacity after taking logarithms.</li> <li>They can be estimated using micro or macro data.</li> </ul>	<p><u>Broad description:</u> Del Gatto et al. (2011) Coelli et al. (2005)</p> <p><u>Törnqvist Index:</u> Caves et al. (1982b) Jäger (2016) Timmer et al. (2007) Feenstra et al. (2015) OECD (2001, 2017)</p>
DEA	<ul style="list-style-type: none"> <li>It follows a nonparametric approach. It is also a frontier TFP measure<sup>28</sup>.</li> <li>Uses mathematical programming to calculate a piece-wise surface linking the 'best-practice' or efficient firms. The production units are then compared to the efficient units.</li> <li>There are no assumption regarding the functional form of the relationship between inputs and outputs and technical change may vary across units.</li> <li>Measurement errors and stochastic noise are measured as inefficiency.</li> <li>It can be estimated using macro or micro data, although the last is more frequent.</li> </ul>	<p>Daraio and Simar (2007) Green (2008)</p> <p><u>Broad description:</u> Del Gatto et al. (2011) Coelli et al. (2005)</p>
SFA	<ul style="list-style-type: none"> <li>It follows a parametric approach. It is also a frontier model.</li> <li>It is usually estimated using maximum likelihood. It can be calculated using other methods such as Bayesian techniques.</li> <li>It includes a stochastic term which accounts for statistical noise.</li> <li>It assumes a functional form for the production function.</li> <li>It assumes the stochastic term follows a specific distribution.</li> <li>It can be estimated using macro or micro data, although the last is more frequent.</li> </ul>	<p>Amador and Coimbra (2007) Green (2008) Kumbhakar et al. (2000) Aigner et al. (1977)</p>
OLS	<ul style="list-style-type: none"> <li>It follows a parametric approach.</li> <li>It requires inputs to be exogenous, i.e. determined independently from the firm's efficient level</li> <li>It can be estimated using micro or macro data.</li> </ul>	<p>Wooldridge (2005)</p>
Within	<ul style="list-style-type: none"> <li>It follows a parametric approach</li> </ul>	<p>Hoch (1962)</p>

<sup>28</sup> Most of the approaches used to estimate TFP assume technical efficient firms operating at the production of possibilities frontier. The efficiency assumption is unlikely to be valid as most firms do not use their inputs at full capacity. In response to this fragility, a different approach has been designed to estimate TFP – frontier models –which do not assume efficiency. In such models, the units of production are compared with each other to compute production possibilities frontier where the best-practice firms lie. This frontier expands whenever technologic improvements are observed. TFP values are computed using the distance function between the production unit and the frontier. (Del Gatto et al. 2011; Coelli et al. 2005)

estimator (Fixed effects)	<ul style="list-style-type: none"> <li>Equation: <math>y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \omega_i + u_{it}^q</math>, k-capital services, l-labour services and m-materials.</li> <li>TFP (<math>\omega_i</math>) is plant specific but time invariant</li> <li>It accounts for simultaneity and selection bias (if TFP is time invariant).</li> <li>It can be estimated using micro or macro data.</li> </ul>	ABBP(2007) <u>Broad description:</u> Van Beveren (2012)
GMM	<ul style="list-style-type: none"> <li>It follows a parametric approach.</li> <li>It uses instrumental variables to solve endogeneity issues. It requires instruments to be correlated with inputs, but not correlated with the error term and without being a part of the production function.</li> <li>It solves selection bias if an unbalanced panel is used.</li> <li>Can be estimated using micro or macro data.</li> </ul>	ABBP (2007) Blundell and Bond (2000)
Olley and Pakes (1994)	<ul style="list-style-type: none"> <li>It follows a semi-parametric approach. It addresses simultaneity and selection bias.</li> <li>In a first stage, the coefficients of labour and the joint effect of the variables capital and productivity are estimated and in a second stage the coefficient of the capital input is calculated.</li> <li>It assumes firms make a decision in each period: exit/continue. If they continue they choose: Labour, Materials, and Investment. A cut-off level of productivity is calculated using expected net cash flows.</li> <li>It assumes only one unobserved state variable – productivity. An Investment variable is also used and it is calculated as follows: <math>I_{it} = K_{it+1} - (1 - \delta)K_{it}</math>.</li> <li>It assumes the investment function is invertible, i.e. it is strictly increasing in productivity.</li> <li>It estimates: <ul style="list-style-type: none"> <li><math display="block">y_{it} = \beta_l l_{it} + \beta_m m_{it} + \varphi(k_{it}, i_{it}) + u_{it}^q</math></li> <li><math display="block">\varphi(i_{it}, k_{it}) = \beta_0 + \beta_k k_{it} + h_t(k_{it}, i_{it})</math></li> </ul> </li> </ul> <p><math>\varphi(i_{it}, k_{it})</math> is approximated by a higher order polynomial in <math>i_{it}</math> and <math>k_{it}</math> (non-parametric portion).</p> <ul style="list-style-type: none"> <li>This first step is used to estimate the elasticities of labour and materials. In order to estimate capital elasticities <math>g</math> - a function of the probability of exit (approximated using a higher order polynomial as before) is used. <ul style="list-style-type: none"> <li><math display="block">y_{it} - b_l l_{it+1} - \beta_m m_{it+1} = \beta_0 + \beta_k k_{it+1} + E(\omega_{it+1}   \omega_{it}, \chi_{it+1}) + \xi_{it+1} + u_{it+1}^q</math></li> <li><math display="block">= \beta_0 + \beta_k k_{it+1} + g(P_{it}, \varphi_{it} - \beta_k k_{it}) + \xi_{it+1} + u_{it+1}^q</math></li> </ul> </li> </ul> <ul style="list-style-type: none"> <li>It is estimated using micro data.</li> </ul>	Olley and Pakes (1994) ABBP(2007) Akerberg et al. (2015)
Levinsohn and Petrin (2003)	<ul style="list-style-type: none"> <li>It follows a semi-parametric approach. It addresses the simultaneity and selection bias (unbalanced panel).</li> <li>It uses a similar approach as Olley and Pakes (1996), but it uses materials instead of investment as the proxy variable.</li> <li>It assumes materials' function is invertible.</li> <li>It assumes productivity - <math>\omega_{it}</math> is the only unobserved state variable.</li> <li>There is a STATA program for the estimation of this method which is called levpct (Petrin, Poi and Levinsohn, 2004).</li> <li>It is estimated using micro data.</li> </ul>	Levinsohn and Petrin (2003) Petrin, Poi and Levinsohn (2004) Akerberg et al. (2015)

Note: several other models have offered improvements to the Olley and Pakes and Levinsohn and Petrin models. Additional information on these models is available in Van Beveren 2012 and Akerberg et al. (2015). Further information on the models is available in the literature surveys, Van Beveren 2011, Del Gatto 2011, Syverson 2011.

## Annex B

### Definitions

Omitted output or input price bias – Firm-level databases usually do not provide price or quantity information for inputs or outputs, and often industry deflators are used to obtain deflated revenue values. This approach can be problematic if prices differences incorporate market power and therefore do not reflect efficiency.; Selection bias – when balanced panels are used, selection bias might occur if higher productive firms are more likely to survive; Simultaneity bias - The correlation between the level of inputs and unobserved productivity shocks is common (endogeneity). It occurs as firms choose their inputs considering their productivity and its evolution.

Estimation algorithm	Main Issues	References
Index numbers	<ul style="list-style-type: none"> <li>It assumes firms are efficient, and the literature on frontier analysis has shown that this assumption is likely to be violated.</li> <li>Aggregation of inputs and outputs might be done using different methods and different weights, giving different results.</li> </ul>	Coelli et al. (2005) Del Gatto (2012)
DEA	<ul style="list-style-type: none"> <li>The results might be affected by outliers</li> <li>Measurement error might influence the shape of the frontier</li> <li>The efficiency estimates are obtained relative to the best performing firms in the sample. If other firms are included the frontier may change, altering the computed values for the other firms</li> <li>Estimates from two different studies are not comparable</li> <li>If the number of observations is small, a lot of them will be included in the frontier</li> <li>Measurement errors and stochastic shocks are measured as inefficiency.</li> </ul>	Coelli et al. (2005) Del Gatto (2012)
SFA	<ul style="list-style-type: none"> <li>The results might be affected by outliers</li> <li>Measurement error might influence the shape of the frontier</li> <li>The efficiency estimates are obtained relative to the best performing firms in the sample. If other firms are included the frontier may change, altering the computed values for the other firms. If the number of observations is small, a lot of them will be included in the frontier</li> <li>Estimates from two different studies are not comparable</li> <li>Assumes a functional form for the production function and assumes the stochastic term follows a specific distribution. If the functional form or the distribution is an incorrect approximation of firm behaviour, results would be biased.</li> </ul>	Coelli et al. (2005) Del Gatto (2012)
OLS	<ul style="list-style-type: none"> <li>The results can be affected by an omitted output price bias and an omitted input price bias (micro data).</li> <li>Simultaneity bias due to endogeneity of inputs can also occur.</li> <li>It requires a balanced panel, creating a selection bias as well.</li> <li>It assumes firms are efficient, the literature on frontier analysis has shown that this assumption is likely to be violated.</li> </ul>	Olley and Pakes (1996) Levinsohn and Petrin (2003) ABBP(2007)
Within estimator/ Fixed effects	<ul style="list-style-type: none"> <li>The results can be affected by an omitted output price bias and an omitted input price bias (micro data).</li> <li>Constant firm productivity assumption may be violated creating biased results</li> <li>Assumes firms are efficient, the literature on frontier analysis has shown that this assumption is likely to be violated.</li> </ul>	Olley and Pakes (1996) Levinsohn and Petrin (2003) ABBP(2007)
GMM	<ul style="list-style-type: none"> <li>The results can be affected by an omitted output price bias and an omitted input price bias (micro data).</li> <li>Instrumental variables might be difficult to find</li> <li>Assumes firms are efficient, the literature on frontier analysis has shown that this assumption is likely to be violated.</li> </ul>	Olley and Pakes (1996) Levinsohn and Petrin (2003) ABBP(2007)
Olley and Pakes (1994)	<ul style="list-style-type: none"> <li>The results can be affected by an omitted output price bias and an omitted input price bias (micro data).</li> <li>Only positive values of investment can be used so that the investment function is invertible. This might be problematic specifically if the database has a lot of firms with null investment.</li> <li>Correlation between the non-parametric term and labour may cause the labour coefficient to be unidentified.</li> </ul>	Levinsohn and Petrin (2003) ABBP(2007) Akerberg et al. (2015)

	<ul style="list-style-type: none"> <li>It assumes firms are efficient, the literature on frontier analysis has shown that this assumption is likely to be violated.</li> </ul>	
Levinsohn and Petrin (2003)	<ul style="list-style-type: none"> <li>The results can be affected by an omitted output price bias and an omitted input price bias (micro data).</li> <li>Only positive values of materials can be used so that the materials function is invertible.</li> <li>Correlation between the non-parametric term and labour may cause the labour coefficient to be unidentified. It occurs more often with when materials are used rather than investment.</li> <li>It assumes firms are efficient, the literature on frontier analysis has shown that this assumption is likely to be violated.</li> </ul>	Olley and Pakes (1996) ABBP(2007) Ackerberg et al. (2015)

### Annex C

	Description	References
OECD	<ul style="list-style-type: none"> <li>TFP growth is estimated as the change in value added (VA) not explained by the change in labour and capital inputs used in the production process.</li> <li>Labour is measured as total number of hours actually worked by employees and self-employed workers.</li> <li>Capital is measured by capital services computed from productive capital stocks derived using the perpetual inventory method. Capital services are broken down into eight types - Computer hardware, Telecommunications equipment, Transport equipment, Other machinery and equipment and weapons systems, Computer software and databases, Non-residential construction, Research and development and Other intellectual properties.</li> <li>OECD also makes an adjustment to the national ICT assets deflators.</li> <li>The aggregation of the change in volume of these inputs is computed using a Törnqvist index with cost shares of the inputs as weights</li> </ul>	OECD (2001) OECD (2009) OECD (2017)
EU-KLEMS	<ul style="list-style-type: none"> <li>The EU-KLEMS database provides two measures of TFP, one computed using valued added with capital and labour as inputs and the other using gross output with capital, labour, energy, materials and services as inputs (KLEMS).</li> <li>The recently published data only includes VA measures of TFP.</li> <li>TFP growth is estimated as the change in value added (VA) not explained by the change in labour and capital inputs used in the production process.</li> <li>It uses capital stock measurements published by Eurostat, the values are computed by national authorities as they often use the perpetual inventory method.</li> <li>Labour services are disaggregated into eighteen groups given the worker's gender, educational attainment (high, medium and low) and age (15-29 years; 30-49 years; 50 years and higher).</li> <li>In the database, TFP is estimated for thirty-four industries as well as for the total economy.</li> </ul>	Jäger (2016) Timmer et al. (2007)
Pen World Table 9.0	<ul style="list-style-type: none"> <li>TFP growth is estimated as the change in value added (VA) not explained by the change in labour and capital inputs used in the production process.</li> <li>The labour input is computed using not only average hours worked but also information on human capital. The latter is computed using a methodology commonly found in the literature (e.g. Caselli 2005) in which human capital is estimated using average years of schooling and rates of return of schooling from Psacharopoulos (1995). The information on years of education can come from Barro and Lee (2013) or Cohen and Soto (2007)/Cohen and Leker (2014) data</li> <li>Capital is also computed in a slightly different way due to restrictions in the availability of data and it is only broken down into four types, instead of the usual eight.</li> </ul>	Feenstra et al. (2015) Feenstra et al. (2016a) Feenstra et al. (2016b)
European Commission	<ul style="list-style-type: none"> <li>TFP is calculated as a residual of a Cobb-Douglas production function with labour and capital inputs measured at their full capacity.</li> <li>The shares of labour and capital considered are the same for all countries and equal to 0.65 and 0.35 respectively.</li> <li>Capital is measured as a stock calculated using the perpetual inventory method.</li> <li>A more complex approach is used to compute labour, with several components being taken into consideration, such as working-age population, trend of the participation rate, trend of rate of people employed (using NAWRU) and trend of the average hours worked.</li> <li>Consequently, the residual of the production function, also captures the degree of utilization of inputs. The Commission then calculates a trend of the residual (TFP) using a Kalman filter, so that the degree of utilization of inputs is extracted.</li> </ul>	Havik et al. (2014)



## 6. Unit Labour Costs and Portuguese External Competitiveness

### **Key messages**

*There is a fairly widespread view that Portuguese external competitiveness has deteriorated significantly in the run up to the recent crisis. This view is often predicated on conventional measures of Unit Labour Costs (ULC) growing above EU average. Yet, it is now well established in the relevant academic literature that ULC are an overly simplistic and potentially misleading indicator of external competitiveness. From 1995 to 2009, the wage share of income in Portugal has barely changed. This implies that ULCs have essentially tracked the Portuguese GDP deflator, which can hardly be seen as a good measure of external competitiveness. Other, more suitable measures are available and portray a very different picture of structural changes in the Portuguese economy and their effects on external competitiveness.*

Unit labour costs (ULC)<sup>29</sup> are a commonly used metric of country-wide external competitiveness. Traditional explanations for rising external imbalances of euro area debtor countries are often based on this measure. There is, in particular, a fairly widespread view that the euro area imbalances are mostly the result of serious competitiveness losses in countries that have accumulated large external deficits, as shown by a widening gap in ULCs between these countries and other European countries that have accumulated large surpluses in the run up to the 2009 crisis (Wyplosz, 2013; Figure 28). This view has been pervasive both in academic debates (e.g. Chen *et al.* 2012) as well as in institutional fora (ESM 2017; IMF 2017; EC 2016).

However, there are a number of important methodological limitations and empirical inconsistencies that call into question the adequacy of that view. In practice, it appears that more complex and nuanced processes have been at play.

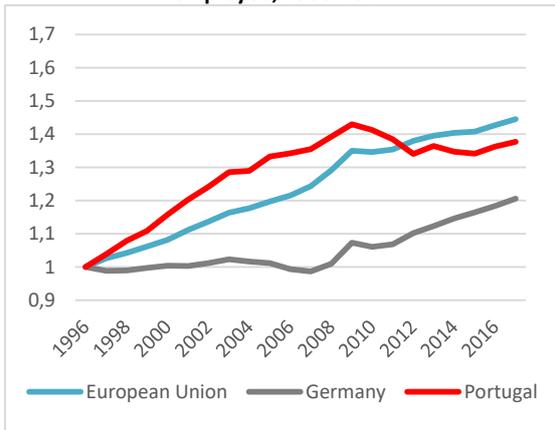
First, and crucially, at the macro level, with multiple goods and services, complex costs structures where labour costs are only one (in some cases relatively small) part of the equation, and changing nominal exchange rates, ULC tell us very little about changes in external competitiveness, even if one takes the narrowly defined concept of cost-competitiveness (e.g. Chinn, 2005; Filipe and Kumar, 2011; Wyplosz, 2013; Knibb, 2015).

At its most basic, standard economy-wide ULC are a ratio with a numerator expressed in nominal terms (the total wage bill per worker) and a denominator expressed in real terms (aggregate labour productivity calculated as the ratio of nominal value added to a deflator, divided by the number of workers). Standard ULC can thus be rewritten as the labour share in total output (value added) multiplied by a price deflator. Filipe and Kumar (2011) show that the increase in ULC in a variety of OCDE countries between 1980 and 2007, essentially reflects the increase in the price deflator used to calculate labour productivity. Labour shares in those countries, Portugal included, have been mostly flat or slightly decreasing. There is no good reason to expect the GDP deflator to be a good metric of external competitiveness.

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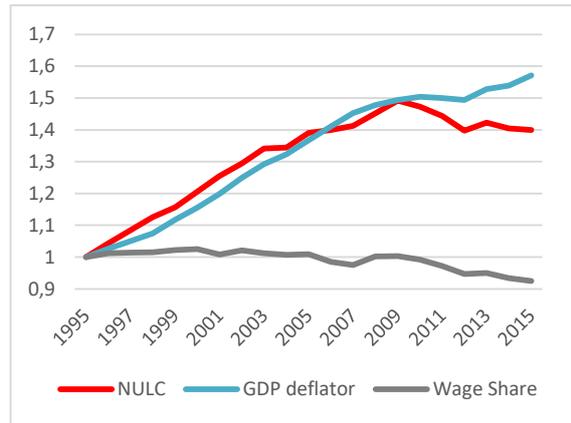
<sup>29</sup> ULC =  $WL/Y$ , where W is nominal compensation per employee, L the number of employees and Y is real GDP)

**Figure 28 - Nominal unit labour costs: Ratio of compensation per employee to real GDP per person employed, 1996-2017**



Source: AMECO, (PLCD).

**Figure 29 - Nominal Unit Labour Costs, Wage Share and GDP Deflator (Portugal, 1995=100)**

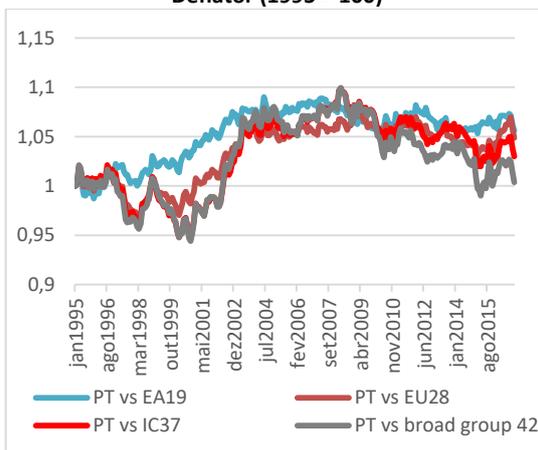


Source: Eurostat and Banco de Portugal.

A better indicator of external cost competitiveness is the real effective exchange rate (REER) measured by comparing the domestic traded good price index and an index of average traded good prices in the partners countries converted in domestic currency when these countries are not part of the euro area. A weaker domestic currency (in real terms) means that it is easier to sell domestic goods abroad.

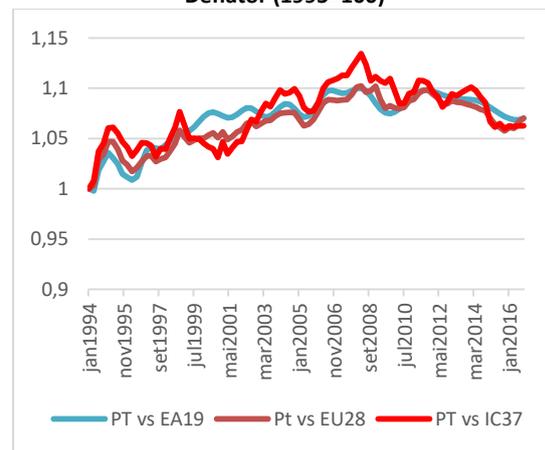
For the purpose of calculating the relative price of goods and services that are tradable, the preferred measure, in theory, is the exchange rate deflated by producer price, wholesale price, or export price indexes (Chinn, 2005). In practice, there are data limitations that imply that these deflators have both advantages and disadvantages compared to general inflation indexes, which makes it important to look at both types of indicators (Figure 30 and 31).

**Figure 30 - Real Effective Exchange Rates, HICP Deflator (1995 = 100)**



Source: European Commission, Price and Cost Competitiveness - Data Section 2016.

**Figure 31 - Real Effective Exchange Rates, Export Prices Deflator (1995=100)**



Source: Source: European Commission, Price and Cost Competitiveness - Data Section 2016.

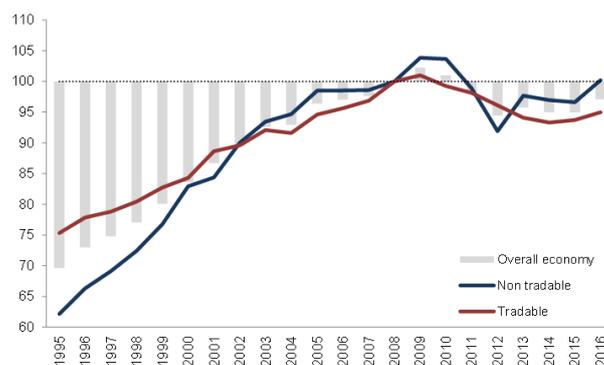
Using REERs rather than ULC as proxies for external cost competitiveness leads to a markedly different pattern. After exhibiting an upward trend from 1995 to around 2004, Portuguese REERs

became broadly stable<sup>30</sup> until recent years when some of these indicators see a slight decline. This is in stark contrast to the view that Portuguese external cost competitiveness has been subject to a sustained process of deterioration from the mid-1990s to the 2009 crisis. Blanchard and Portugal (2017) make a similar point when they acknowledge that “the CPI-based real exchange rate has barely moved relative to its European Union partners, going from 100 in 2005 to 99.9 in 2013, and 98.6 in 2015”, and yet export growth “has actually been relatively strong” (p.13).

Second, the ULC-based explanation of external imbalances is undermined by empirical evidence suggesting that, in the run up to the 2009 crisis, ULC were de-correlated from export growth and that current account imbalances within the euro area were not generally driven by export performance. This is a well-established empirical regularity – known as the Kaldor Paradox (Kaldor, 1986) - whereby the evolution of export market shares is uncorrelated or even positively correlated with growth in ULC.

On the contrary, the bulk of the widening gap in ULCs between deficit and surplus countries came from price developments in the non-tradable sector (Figure 32), which are typical of a demand shock rather than of a competitiveness shock (e.g. Gaulier and Vicard, 2013).

**Figure 32 - Unit Labour Costs, Tradables vs Non-Tradables (Portugal)**

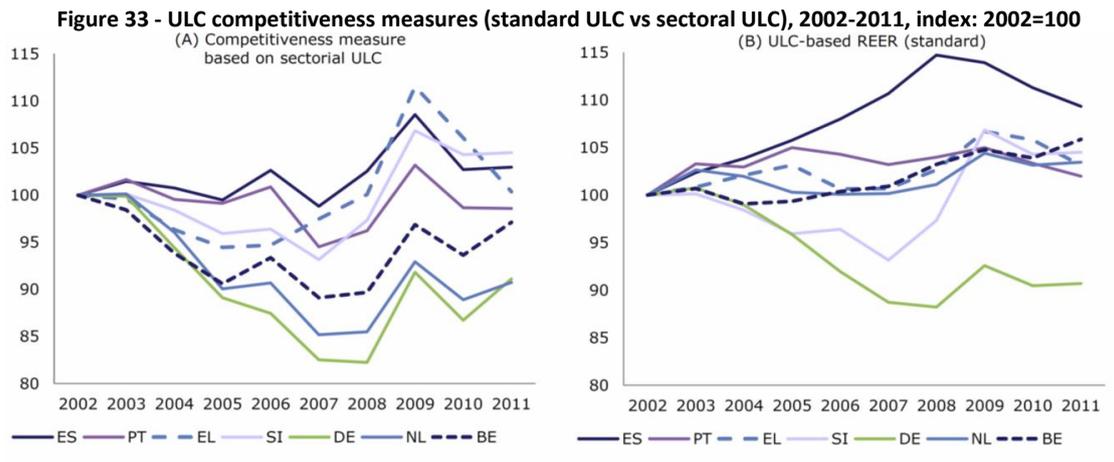


Source: Eurostat.

Third, the ULC-based explanation of external imbalances is inconsistent with the evolution of individual sector ULC indicators. These are important as they filter out movements in standard, aggregate ULC measures that may simply reflect changes in the sectoral composition of the economy<sup>31</sup> rather than in individual sectoral competitiveness. When applied to euro area countries, these indicators show little sign of significant losses in cost competitiveness in Portugal and in other countries that have accumulated large external imbalances (Figure 33). This stresses the point that a country can build external vulnerabilities without losing cost-competitiveness in each sector of specialisation. A boom in aggregate demand (notably resulting from credit) may shift resources toward non-traded sectors, with a minor impact on the relative ULC of each sector. However, this shift would increase the current account deficit and lead to unsustainable dynamics (EC, 2014; Comunale and Hessel, 2014).

<sup>30</sup> If one discounts the volatility that is typical in these sorts of indicators.

<sup>31</sup> A decrease in the aggregate ULC could reflect a reduction in unit labour costs in some sectors, an expansion of the sectors with lower unit labour costs, or a combination of the two. Thus, a shift of resources toward sectors with low (or high) absolute ULC would be interpreted as competitiveness gain (or loss) whether or not the sector attracting resources was more competitive (i.e. had lower ULC than other countries) in foreign markets. The sectoral ULC indicator presented in Figure 33 is produced by evaluating competitiveness at sector level (i.e. ULC-based REER per sector) and then aggregating over all sectors in the economy to get an economy-wide measure of competitiveness.



(1) Competitiveness against (a) the rest of the EU (and Norway) and (b) against the rest of the EU.

Source: European Commission, "Quarterly Report on the Euro Area", 13(2), 2014.

Fourth, the ULC-based explanation of external imbalances fails to capture the full granularity of the macroeconomic environment surrounding Portugal and some other European countries in the early 2000s. In particular, it has been shown that large current account imbalances of individual euro area countries reflected to an important extent the asymmetric impact of trade shocks originating outside the euro area. The lion share of those countries' real exchange rate appreciations between 2000 and 2009 was accounted for by the nominal appreciation of the euro vis-à-vis other currencies. Other trade shocks originating outside the euro area — most notably the entry of China in the WTO, the integration of Central and Eastern Europe in the European Single Market, high commodity prices — also contributed to the widening of euro area imbalances (e.g. Chen *et al.* 2012).

Last, but certainly not least, the ULC-based explanation of external imbalances is at odds with mounting evidence that foreign demand and the real exchange rate alone are incapable of fully explaining exports developments. It is now widely acknowledged that non-price related factors ranging from domestic demand to the effects of globalisation and the mechanics of European Economic and Monetary Union, have become increasingly important for export performance (e.g. Baumann and di Mauro, 2007; di Mauro and Forster, 2008; Storm and Naastepad, 2015; Autor *et al.* 2017). In Chapter 7 we elaborate on metrics of non-cost factors, derived from granular data.

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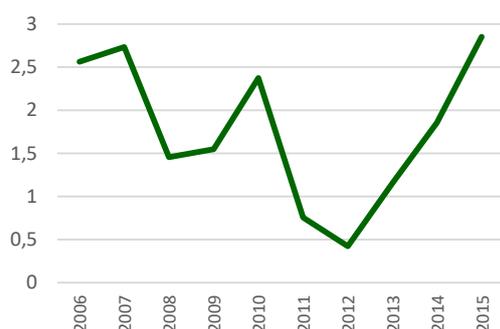
## 7. The recovery of firms' profitability

### Key messages

*Firms' profitability has recovered in recent years (2012-2015), with positive contributions from a variety of costs, only slightly offset by taxes and payroll expenditures. These developments were broad-based across firms in different sectors (apart from the utilities sector) and with different sizes, with a large number of SMEs moving from decreased to increased profitability.*

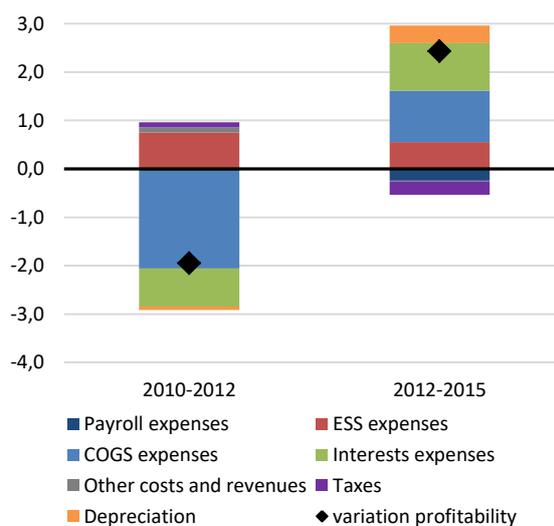
Analysis of firm-level data (Informação Empresarial Simplificada - IES) shows two distinct periods in terms of the profitability of Non-Financial Corporations: 2010-2012, where profits declined, and 2012-2015, when they recovered (Figure 34)<sup>32</sup>. Looking at the components of profit and loss accounts (Figure 35), it seems clear that the recovery of profits in recent years was essentially associated with changes in the costs of goods sold (COGS), interests and external services and supplies (ESS) expenses<sup>33</sup>. Payroll expenses paid virtually no role in this recovery.

Figure 34 - Evolution of firms' profitability, weighted by turnover



Source: Authors' own computations using IES.

Figure 35 - Contribution of profit and loss components to changes in profitability (weighted average by turnover), in p.p.

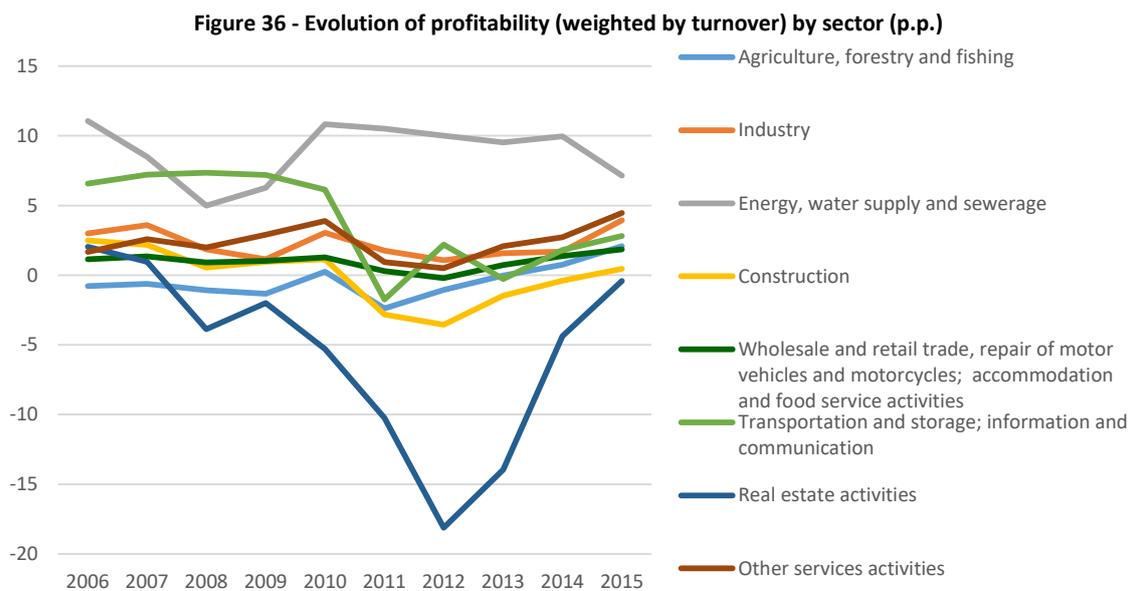


Source: Authors' own computations using IES.

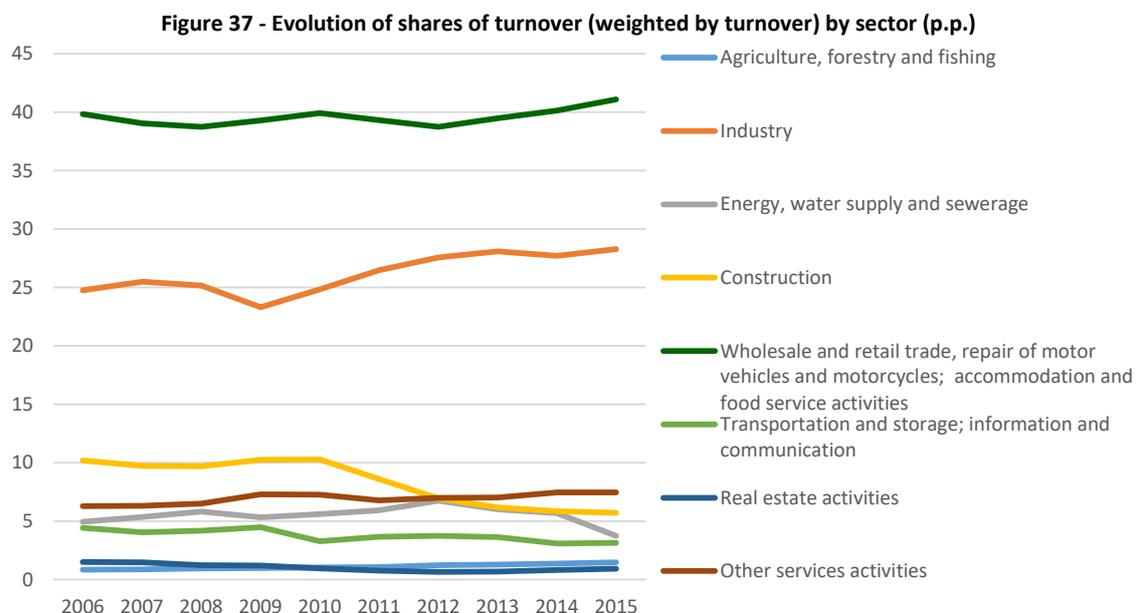
In terms of sectoral developments, the recovery of profits cuts across a wide range of sectors (Figure 36). Apart from energy, water supply and sewerage, all other sectors exhibit an upward tendency since 2012. In addition, there has been a number of important sectoral shifts taking place since 2010 (Figure 37), whereby more profitable sectors gained weight vis-à-vis less productive ones (e.g. industry v. construction).

<sup>32</sup> For details of the methodology and data used please refer to Annex 1 to this section.

<sup>33</sup> A similar analysis using the BACH database (Banco de Portugal, 2017c) shows that between 2006 and 2015, profitability increased as a result of a decrease in variable costs, counteracted by the increase in payroll expenses and financial costs.



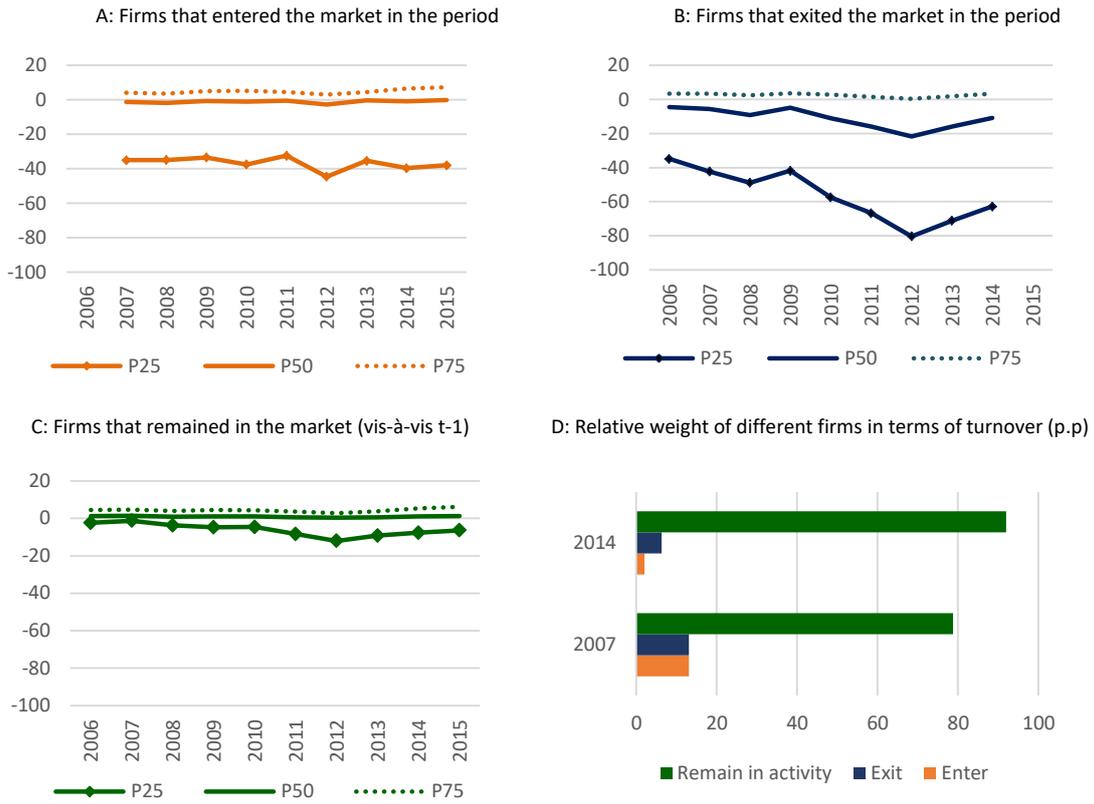
Source: Authors' own computations using IES.



Source: Authors' own computations using IES.

To further understand the recovery in profits, it is useful to distinguish between three groups of firms: those that remain in activity (intensive margin), as well as those that enter or exit the market in a certain year (extensive margin). It is clear there is a great deal of heterogeneity across these different groups (Figure 38). Firms that remain in activity represent more than 90% of all firms' turnover, which means their performance (an increase in profitability since 2012, particularly amongst the least profitable) has been driving the results. Both firms that remain in activity and new firms have higher profitability than those that exit the market, but the gap has been declining since 2012, reducing the strength of the extensive margin channel.

**Figure 38 - Evolution of profitability of firms and share of turnover by total turnover in p.p.**



Source: Authors' own computations using IES.  
P25 – 25th Percentile; P50 – 50th Percentile; P75 – 75th Percentile

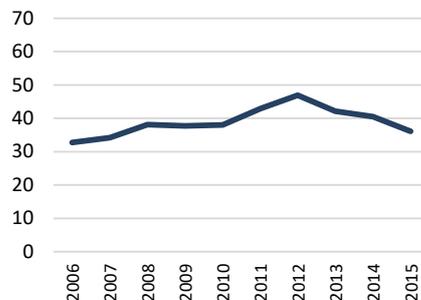
The pivotal role of incumbent firms makes it especially important to understand what has been driving their performance. The share of incumbent firms decreasing their profits had increased since 2009 but the tendency was reverted from 2012 to 2013, stabilizing since then (Figure 39). Unprofitable firms represented almost 50% of total turnover of incumbents in 2012, increasing steadily from 34% in 2007 (Figure 40). From 2012 onwards, the turnover share of unprofitable firms has been steadily declining, accounting for close to one-third of turnover in 2015 (close to the minimum of the available time-series, in 2007).

**Figure 39 - Evolution of the share of incumbent firms that decreased their profitability from one period to the next (% of total number of incumbents)**



Source: Authors' own computations using IES.

**Figure 40 - Evolution of the share of turnover of incumbent firms with negative profitability (% of total turnover of incumbents).**



Source: Authors' own computations using IES.

Table 1 provides information on the differences between firms that have increased their profitability relative to the firms that decreased their profitability in the period 2010-2012. Table 2 provides the same information for the following period, 2012-2015. While the two periods incorporate very different dynamics in profitability (with most firms decreasing their profitability in the first period and increasing it in the following period), on both occasions firms that increased their profitability shared similar features: they were on average younger and more productive; they had, on average, decreased their expenses in payroll, ESS and COGS (as shares of turnover); and benefited from a reduction in interest expenses. The opposite dynamics applied to firms that decreased their profitability.

**Table 1 - Differences between firms that experience an increase in profitability relative to the firms that decreased their profitability in the period 2010-2012**

	Firms that did not increase their profitability	Firms that increased their profitability	Diff
Age (in 2012)	15.99	14.78	1.22***
Turnover (in millions €, in 2012)	1.30	1.38	-0.08
Employees (in 2012)	11.22	10.11	1.11**
Liabilities/Assets (pp, in 2012)	530.83	128.40	402.43
GVA per employee (in thousands €, 2012)	15.05	24.36	-9.31***
Variation in share of taxes (pp turnover)	-0.21	0.97	-1.19***
Variation in share of interests expenses (pp of turnover)	1.24	0.32	0.92***
Variation in share of payroll expenses (pp turnover)	11.22	-6.26	17.48***
Variation in share of ESS (pp turnover)	6.36	-6.39	12.76***
Variation in share of COGS (pp turnover)	3.54	-2.82	6.36***
Number of firms	124 336	63 972	

Source: Authors' own computations using IES

Note: Variations are calculated as the difference between the share in 2012 and the share in 2010. \*\*\*p<0.01 \*\*p<0.05 \*p<0.1

**Table 2 - Differences between firms that experience an increase in profitability relative to the firms that decreased their profitability in the period 2012-2015**

	Firms that did not increase their profitability	Firms that increased their profitability	Diff
Age (in 2015)	17.28	17.16	0.13**
Turnover (in millions €, in 2015)	1.31	1.55	-0.24*
Employees (in 2015)	11.14	12.23	-1.09*
Liabilities/Assets (pp, in 2015)	276.96	147.79	129.17***
GVA per employee (thousands €, in 2015)	14.79	26.31	-11.52***
Variation in the share of taxes (pp turnover)	-0.54	0.66	-1.21***
Variation in the share of interests expenses (pp of turnover)	0.16	-0.67	0.83***
Variation in the share of payroll expenses (pp turnover)	9.56	-7.80	17.36***
Variation in the share of ESS expenses (pp turnover)	4.15	-6.31	10.46***
Variation in the share of COGS (pp turnover)	4.05	-2.79	6.84***
Number of firms	124 336	63 972	

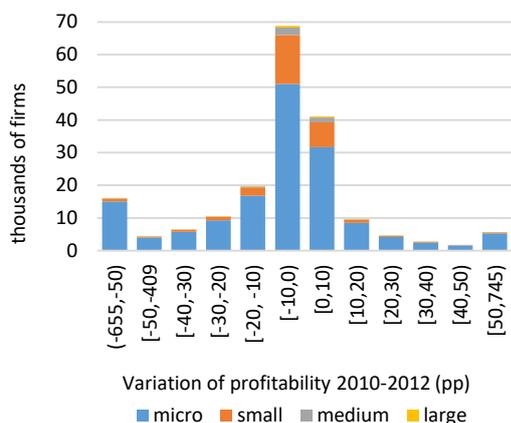
Source: Authors' own computations using IES.

Variations are calculated as the difference between the share in 2012 and the share in 2010. \*\*\*p<0.01 \*\*p<0.05 \*p<0.1

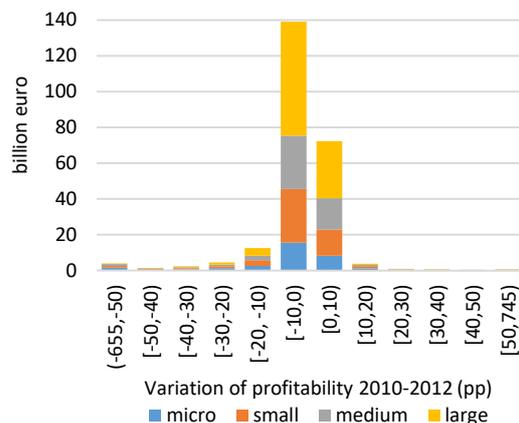
Finally, it is important to understand if changes in profitability in recent years are driven by a small number of large firms or if there are more broad-based. Figure 41, Panels A and C, shows that from 2010-2012 to 2012-2015, there was a large number of SME moving from low to high profitability. Panels B and D show that in terms of turnover, all size groups had important contributions to the increase in profitability<sup>34</sup>.

**Figure 41 - Distribution of firms and turnover by the variation in profitability in periods 2010-2012 and 2012-2015**

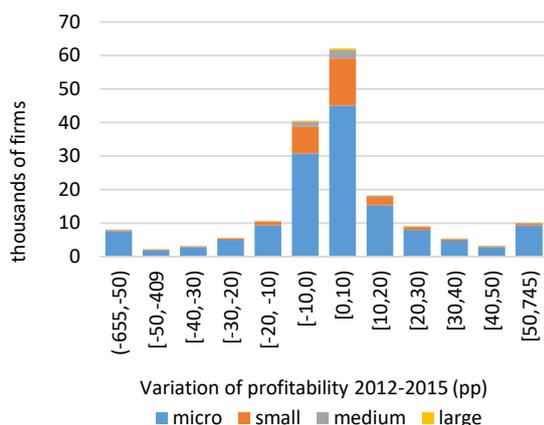
A – Distribution of number of firms by variation in profitability in pp for the period 2010-2012



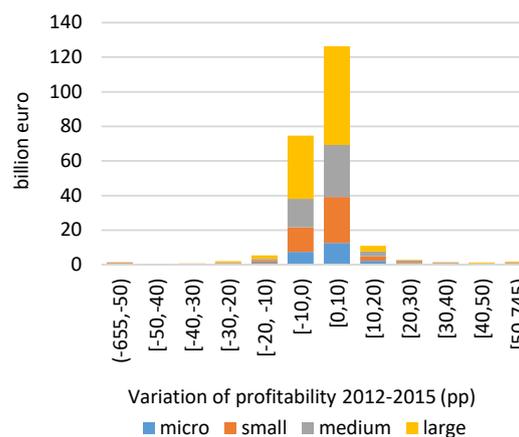
B – Distribution of turnover (average of 2010 and 2012) by variation in profitability in pp for the period 2010-2012



C – Distribution of number of firms by variation in profitability in pp for the period 2012-2015



D – Distribution of turnover (average of 2012 and 2015) by variation in profitability in pp for the period 2012-2015



Source: Authors' own computations using IES.

<sup>34</sup> Aggregate profitability is computed as a weighted average of the profitability ratios of individual firms. The size of the firm, defined by the share of the firm's turnover in total turnover, is used as the weights.

## Annex 1 - methodology

We rely on the IES dataset (Informação Empresarial Simplificada), which contains accounting data for all Portuguese firms over the 2006-2015 period. The analysis focuses on Non-Financial Corporations. We exclude firms from the following sectors: Financial and insurance activities, Human health and social work activities, Arts, entertainment and recreation activities, Activities of households as employers, undifferentiated goods and services-producing activities of households for own use and Activities of extraterritorial organizations and bodies. To ensure the robustness of the analysis, we exclude firms with negative, null or missing values of assets, turnover, payroll expenses and number of employees.

*Profitability* is computed as the ratio between net income (calculated as the sum of all revenues net of all costs incurred by the firm) and turnover. Outliers above the 99th or below the 1st percentiles are excluded. The cost and revenue's components, taken from the Profit and Loss account, are split into Payroll expenses, Cost of goods sold (COGS), External supplies and services (ESS), Interest paid, Taxes, Depreciation, and Other costs and revenues. For the decomposition of profitability, the ratio of each component over turnover is used.

$$Profitability = \frac{Turnover - Payroll\ exp. - ESS\ exp. - COGS - Interest\ paid. - Taxes - Amortizations + Other\ Costs\ and\ Revenues}{Turnover}$$

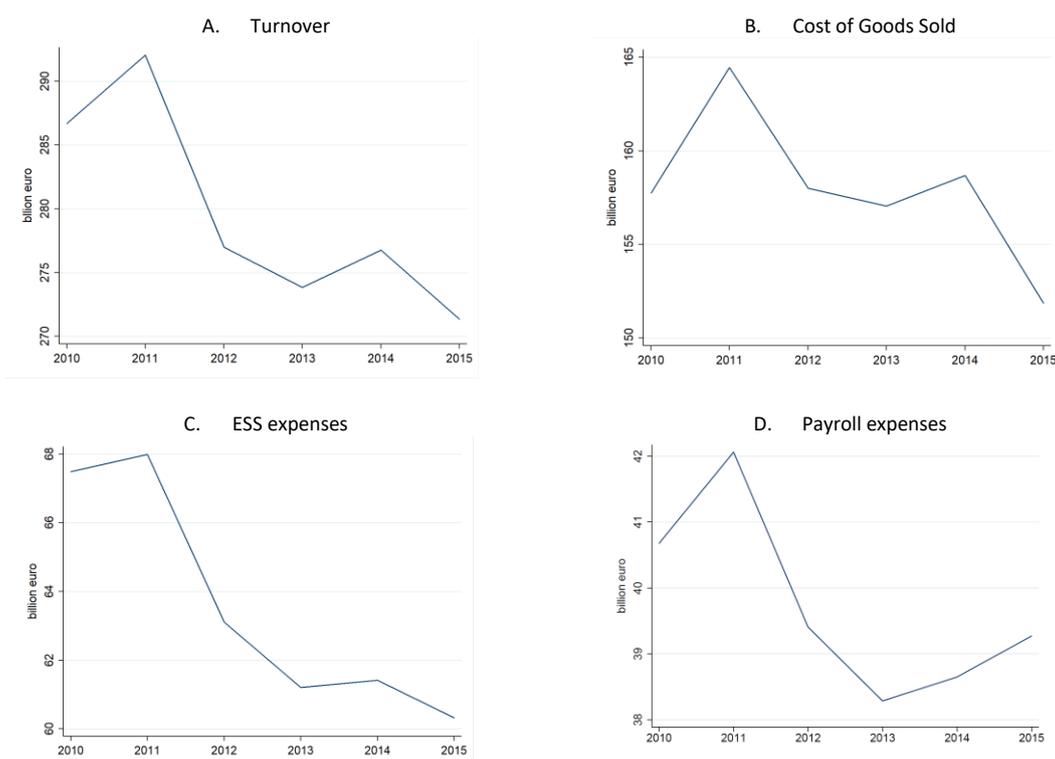
Three sets of firm are considered in the analysis. The first contains all firms; the second includes information regarding firms that are operating in all years between 2010-2012; and the third those operating in all years between 2012-2015. Table A1 provides information on the number of firms for the three sets. Table A3 presents the evolution of the components of profitability in level.

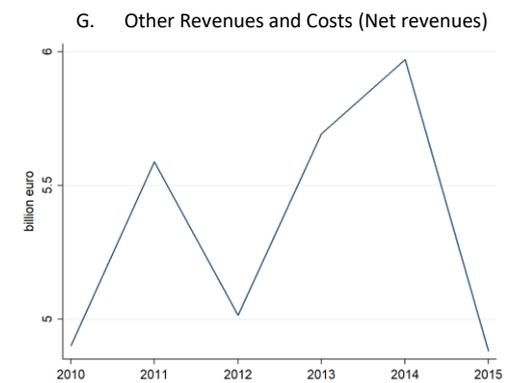
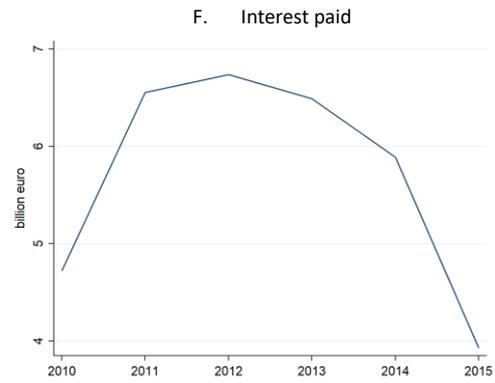
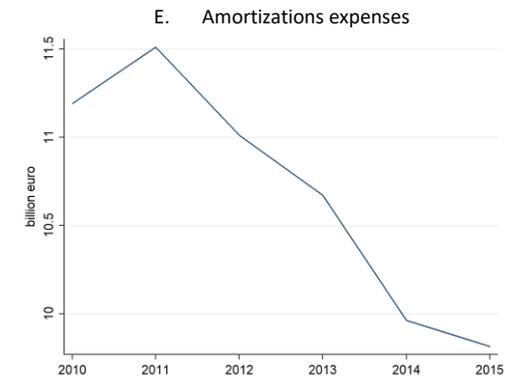
**Table A1. Number of firms: profitability analysis**

	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>All firms</b>	<b>125 829</b>	<b>131 482</b>	<b>141 428</b>	<b>129 287</b>	<b>126 462</b>	<b>129 493</b>	<b>126 974</b>	<b>125 651</b>	<b>124 201</b>

Source: Authors' own computations using IES

**Table A2. Evolution of the components of profitability (total across firms)**





Source: Authors' own computations using IES

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## 8. Understanding export performance: beyond cost-competitiveness

### Key messages

*We offer an overview of the Portuguese export performance in the last two decades. While there is broad agreement that this performance has been relatively successful, its drivers remain a source of debate. We contribute to this discussion by going beyond traditional export performance indicators, usually focused on cost-competitiveness. Relying on granular indicators of relative export prices and export market shares, we highlight the role of non-cost factors, which have allowed the country to make steady competitiveness gains.*

#### i. Introduction

Disparities amongst countries in terms of export performance are generally explained by a number of factors of which relative prices (cost/price competitiveness) and the strength of foreign demand are often seen as critical. The available empirical evidence, however, shows that those factors can only partially explain a country's external performance. Higher prices may actually reflect higher quality which, in turn, is linked with higher wages (Fagerberg, 2002).

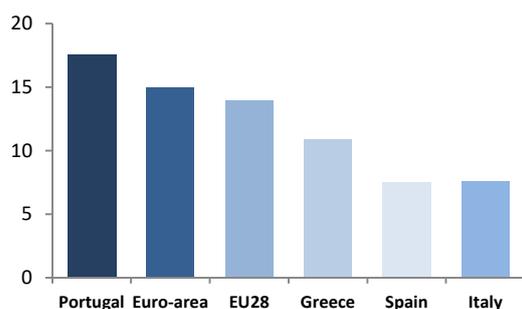
There are thus other factors beyond relative prices and external demand that must be considered and that can be broadly labelled as non-cost competitiveness. This includes factors such as the position on the quality ladder, the participation in Global Value Chains, quality and availability of infrastructure and institutional factors.

In this Chapter, we depart from an overview of the evolution of Portuguese export performance in recent years. We then assess the drivers of these developments, providing micro-based evidence of the role of non-cost competitiveness gains.

#### ii. Portuguese export performance

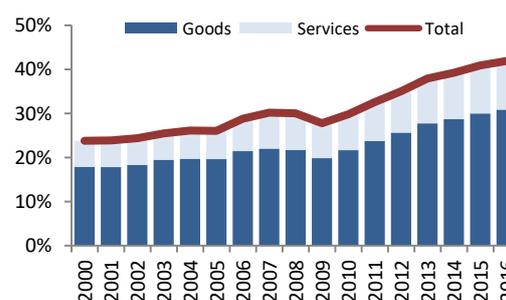
From 2002 – the year the Euro entered into force – to 2016, the weight of total exports in GDP increased by 18p.p. in real terms, being now above 40% (Figure 42 and 43). This improvement, which started before the crisis and that was amplified by it (European Commission, 2016), is more than 3p.p. above similar increases in the 19 euro area countries. It was driven by a rise of 12p.p. in goods and of 5p.p. in services, which doubled their weight.

**Figure 42 - Exports of goods and services/GDP, p.p. change - real terms (2002-2016)**



Source: Eurostat

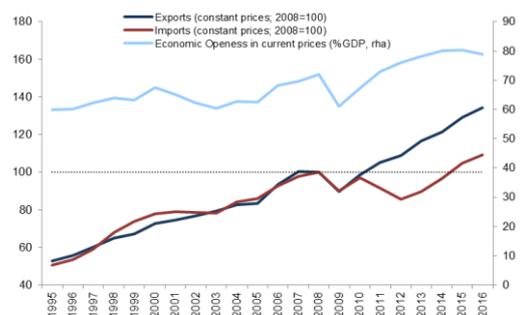
**Figure 43 - Exports of goods and services, % GDP – real terms**



Source: Eurostat

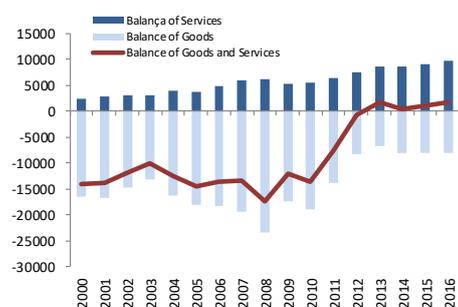
The strong performance of total exports was not accompanied by similar increases in imports, which decreased since 2008 and up to 2012, resuming growth since then (Figure 44). As a result, Portugal increased its degree of economic openness by roughly 20p.p.<sup>35</sup> Furthermore, Portugal's trade balance has been positive since 2013 and should remain so in the forthcoming years (MF, 2017; IMF, 2017; COM, 2016)<sup>36</sup>, with a strong reduction in the deficit in traded goods<sup>37</sup> and a growing surplus in traded services (Figure 45).

**Figure 44 – Economic Openness (goods and services)**



Source: Statistics Portugal

**Figure 45 – Balance of Goods and Services (M€, nominal terms)**



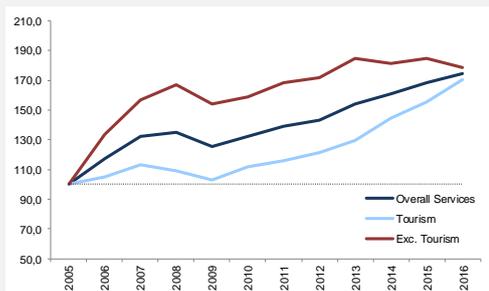
Source: Statistics Portugal

### Box 5 – The role of Tourism

Even though Tourism is an important component of the Portuguese exports of services (roughly 50% of overall services exported), Figure 5.1 shows that exports of services were driven, up until 2013, by export of other services, which have only recently started losing momentum, offset by an acceleration in Tourism. Additionally, whilst exports of Tourism have accelerated in the last 3 years, employment in the sector (employment in accommodation and food services) has only started growing more recently, and with a moderate impact on overall employment.

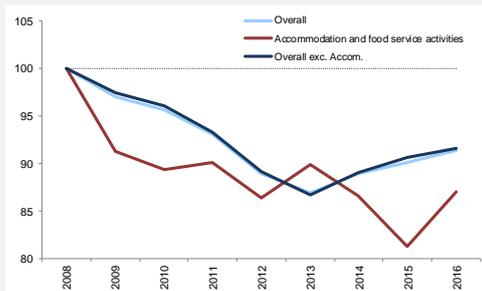
From 2013 onwards, the average quarterly growth of Tourism was above 11%, coupled with a steady increase in prices in sectors such as restaurants and hotels<sup>38</sup>. These points to non-cost competitiveness gains in the sector rather than price/costs causes.

**Figure 5.1 – Exports of services (constant prices, 2005=100)**



Source: Statistics Portugal

**Figure 5.2 – Employment developments(2008=100)**



Source: Eurostat

<sup>35</sup> According to Banco de Portugal's Economic Bulletin June 2017, Portugal has margin to further improve, as it is still below the OECD average degree of openness (104%). Also, taking into account factors such as the size of the Portuguese economy, the level of obstacles to trade, the economic development and this participation in global value chains, Banco de Portugal estimates a potential degree of economic openness of around 90-100%, which is above the figures currently registered, meaning that there is still margin for further increases in upcoming years.

<sup>36</sup> Up to at least 2022 – the last year of the forecast horizon.

<sup>37</sup> Half of the EU28 countries show a deficit in the trade balance of goods.

<sup>38</sup> From January 2013 until October 2017, consumer prices for Restaurants and Hotels has increased 14.4 % (Statistics Portugal).

## Box 6 – The importance of global value chains

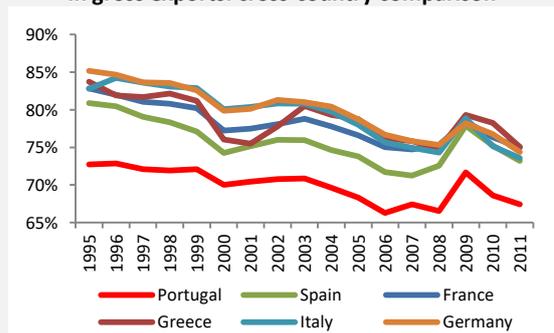
The increasing importance of global chains of production is the most prominent feature of globalisation (Amador and Cabral, 2014). This box sheds further light on the Portuguese external sector performance by exploring the role of Portugal in Global Value Chains (GVCs). For this assessment, we rely on a set of indicators from CompNet<sup>39</sup> (ECB, 20015), which are based on the methodology of Koopman et al. (2010), Koopman et al. (2014) and Timmer et al. (2012) and are compiled using data from the World Input-Output Database (WIOD)<sup>40</sup>. In particular, we present data on the relevance of domestic value added, on the position and participation in the GVCs and, finally, on revealed comparative advantages.

### i. Domestic value added

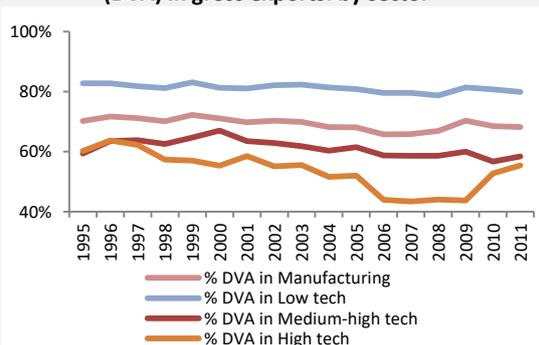
Measures solely based on gross nominal exports are likely to overstate the importance of the export sector in a country's economy, as they may be reflecting increasingly embodied imports<sup>41</sup>. The decomposition of gross exports, corrected for imported value added (trade in value added), provides a better understanding of a country's performance.

Figure 6.1 presents the evolution of the share of domestic value added (DVA) in gross exports. The downward trend for the case of Portugal is shared by other European countries. Despite presenting a lower DVA than the EU28, it has reduced the gap by half, from 8p.p. in 1995 to 4p.p. in 2011. Furthermore, an analysis by sector shows that the DVA reduction was a broad-based tendency<sup>42</sup>. The more accentuated downward path followed by high-tech was interrupted in 2006, increasing again after 2009.

**Figure 6.1 - Evolution of domestic value added (DVA) in gross exports: cross-country comparison**



**Figure 6.2 - Evolution of domestic value added (DVA) in gross exports: by sector**



Source: Trade in Value Added (TiVA), OECD's Inter-Country Input-Output (ICIO) database and authors' own computations

### ii. Position and participation

The capacity to increase GDP growth through exports depends on the volume of trade and on the incorporation of DVA. In that sense, as argued by Baldwin (2012), it is important to have exporting firms located in the stages of GVCs where the major part of value added is created, namely pre-fabrication (R&D, product conceptualization and

<sup>39</sup> The Competitiveness Research Network (CompNet) is a hub for research and policy analysis on competitiveness and productivity from the European Central Bank.

<sup>40</sup> This database combines information from national supply and bilateral trade in goods and services for 40 countries and 35 industries, over a time series from 1995 to 2011.

<sup>41</sup> The geographical fragmentation in the production process translates into new challenges to statistical authorities, as products in different phases of production pass barriers several times, possibly translated into double counting.

<sup>42</sup> The definition of high, medium-high and low tech and manufacturing follows the one of OECD (2003). High-tech englobes aircraft and spacecraft; pharmaceuticals; office, accounting and computing machinery; communications equipment and optical instruments. Medium-high tech englobes electrical machinery and apparatus; motor vehicles, trailers and semi-trailers; chemicals excluding pharmaceuticals; railroad equipment and machinery and equipment. Low tech englobes manufacturing, n.e.c.; recycling; wood, paper products, printing and publishing; food products, beverages and tobacco and textile products and footwear. Manufacturing englobes the components of low-tech and the components of basic metals and fabricated metal products.

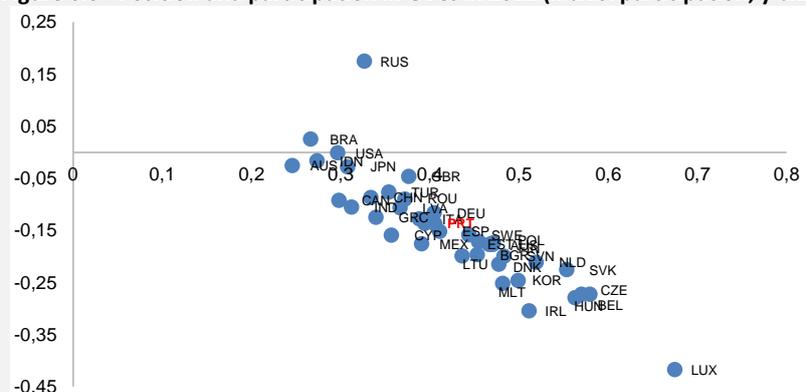
design) or stages close to final consumer (sales, marketing and other after-sale services). Intermediate levels of production, especially assembly, tend to create less value added. The indicators of participation and position in the GVC give an insight on the integration of a country's economy in such stages.

The indicator of participation in GVCs is defined as the sum of a country's supply of intermediate goods used in other countries' exports and the use of imported intermediates in its own production of gross exports. It is a trade openness indicator, as it measures the level of integration into the global economy: a higher value translates into a deeper integration.

The measure of the position in the global value chain is defined as the log ratio of a country's supply of intermediates used in other countries' exports to the use of imported intermediates in its own production. It captures a country's position in international value chains relative to other countries. A high value indicates that a country operates mainly in providing inputs, e.g., raw materials, to be processed abroad, while a lower value indicates that a country mostly operates in final assembly of goods to be exported.

As can be seen in Figure 6.3, the participation index negatively correlates with position in GVCs: countries with lower participation tend to be situated upstream in the production chain. According to ECB (2015), smaller countries usually have high foreign value added in exports whilst large countries are better able to produce inputs domestically and therefore exhibit lower import content.

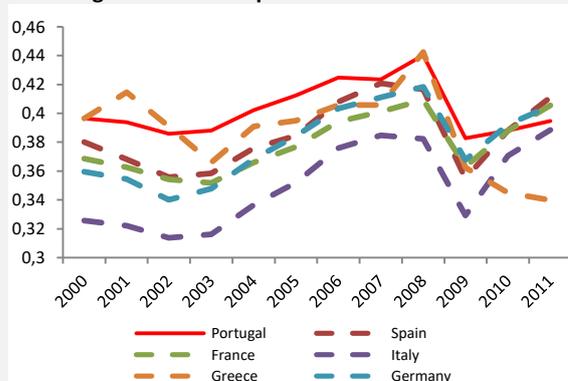
**Figure 6.3 - Position and participation in GVCs in 2011 (x-axis: participation, y-axis: position)**



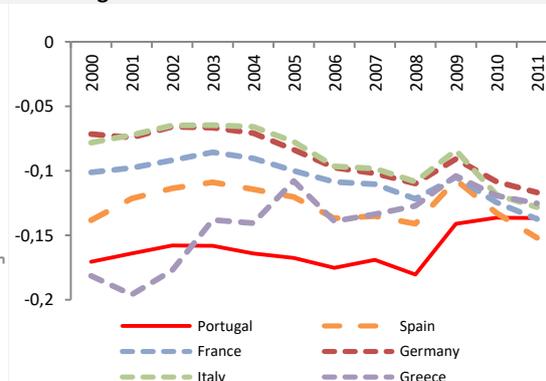
Source: \_CompNet Diagnostic Toolkit for Competitiveness and authors' own computations

By taking a closer look into the developments for Portugal, one sees that the participation indicator (Figure 6.4) was in an upward trend up since 2002. However, in line with the developments in other countries, the global financial crisis induced a downward level shift, that is gradually being reversed. An increased participation may be beneficial in the long-run, since a country tends to participate in the tasks where it has the largest comparative advantage. The position indicator was stable up to 2008, but has increased more recently, hinting at a slight downgrade in the GVC (Figure 6.5). However, current values are broadly in line with those of other European countries.

**Figure 6.4 - Participation in GVC Indicator**



**Figure 6.5 - Position in the GVC Indicator**



Source: CompNet Diagnostic Toolkit for Competitiveness

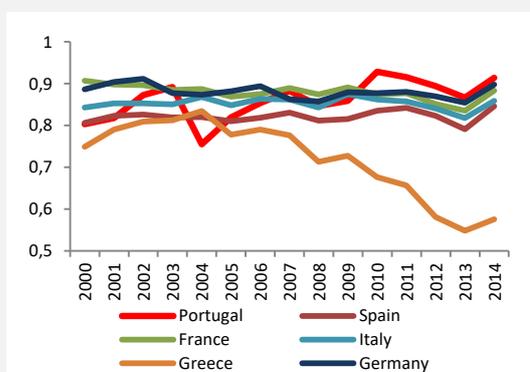
### iii. Revealed Comparative Advantage

An additional indicator that translates the involvement of the economy in GVC is the index of Revealed Comparative Advantage (RCA). Based on the work of Balassa (1965), it measures the importance of a sector in total exports of a country in relation with the importance of that sector in global exports flows, capturing the relative advantage or disadvantage of a country in a certain class of goods and services. If a country presents value higher than 1 (the benchmark threshold), it presents comparative advantage in the sector under analysis.

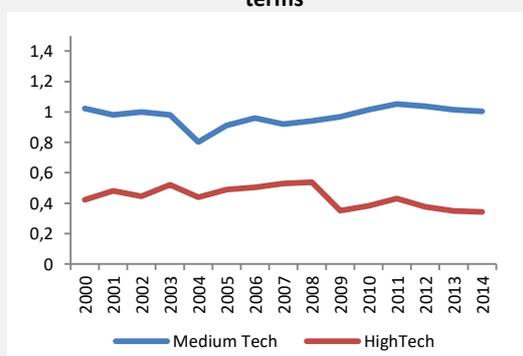
Looking to the total domestic value added of Portuguese gross exports, we can see that 40% corresponds to the value added in the production of intermediate goods. Between 2000 and 2014, that share increased 3p.p. It is thus important to understand the patterns of comparative advantage in the exports of intermediate goods. Since 2004 Portugal has been steadily improving its comparative position, surpassing several of its EU peers.

The RCA of exports of medium-high tech also presents a positive trend, increasing its position since 2003. For high-tech, the indicator is broadly stable, after a downward level-shift in 2009.

**Figure 6.6 - Revealed comparative advantage in exports of intermediate goods, nominal terms**



**Figure 6.7 - Revealed comparative advantage in exports of goods in medium and high tech, nominal terms**



Source: CompNet Diagnostic Toolkit for Competitiveness and authors' own computations

Note: The definition of high, medium-high and low tech and manufacturing follows the one of OECD (2003)

### iii. Driving forces: an assessment of non-cost competitiveness based on micro-level data

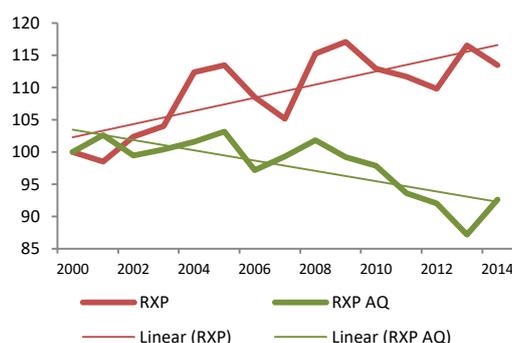
What is driving these positive external developments? In light of most traditional indicators, such Real Effective Exchange Rate (Figure 30 and 31), there are no major cost-competitiveness changes in recent years. As stated by Blanchard and Portugal (2017), "contrary to the textbook adjustment, relatively strong export growth has come without a significant decrease in relative prices. [...] The CPI-based real exchange rate has barely moved relative to its European Union partners, going from 100 in 2005 to 99.9 in 2013, and 98.6 in 2015.". In any case, REER measures also have a number of important limitations, as for instance they implicitly assume that the elasticity of substitution between any two suppliers is the same for each commodity/product (Spilimbergo and Vamvakidis, 2000; ECB, 2015) and they hide possible sectoral recompositions. Furthermore, as argued by Benkovskis and Wörz (2014), price-cost indicators ignore any other factors beyond costs and prices that are essential to adequately measuring competitiveness.

To address these issues, Benkovskis and Wörz (2013), develop two alternative measures of competitiveness, based on highly disaggregated trade data: the relative export prices (RXP), which measures price/cost competitiveness factors based on relative units values, the "euro per kg" definition; and the relative export prices adjusted for quality (RXP AQ), combining both price and non-price competitiveness factors (changes in consumers' tastes and in products' quality), based

on the “euro per unit of utility”<sup>43</sup>. By comparing the two indexes (RXP and RXP AQ), one can measure changes in non-price competitiveness.

Overall, in the period 2000-2014, the RXP for Portugal presented a positive trend (Figure 46), suggesting there has been some loss in price competitiveness. However, during the same period, Portugal improved its position in the RXP-AQ indicator, particularly after 2008, which hints at gains in non-price competitiveness.

**Figure 46 - Relative export prices and relative export prices adjusted for quality (2000=100)**



Source: CompNet Diagnostic Toolkit for Competitiveness. Note: An increase in the indicator reflects a loss in competitiveness

This evidence emphasizes the importance of non-cost factors, with cost factors playing at best a limited role in recent improvements in external performance. Moreover, microdata analysis excludes the possibility that firms have been consistently preserving their external quota via reduction in relative prices and that gains in competitiveness are of a structural nature (Banco de Portugal, 2016). Portugal’s positive export performance is associated with the reorientation of productive factors into the tradable sector, “based on a business restructuring that began before the international financial crisis, and is not accompanied by systematic declines in unit prices” (Banco de Portugal, 2016). OECD (2017) and Correia and Gouveia (2016) argue that there are gains both in the intensive and extensive margins, with existing exporters exporting more but also with more companies exporting.

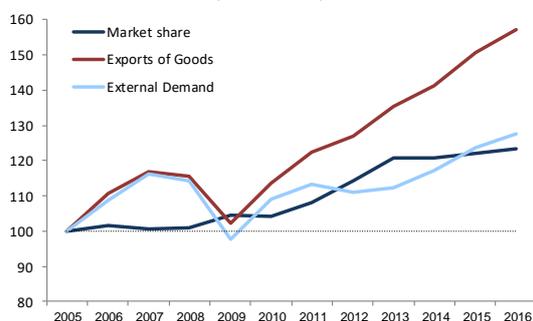
The comparison of the evolution of the Portuguese market share with that of Terms of Trade corroborates the findings on the relevance of non-cost factors<sup>44</sup>. In fact, from 2005 to 2016, the market share of goods increased by 23% (Figure 47) while the terms of trade have also improved,

<sup>43</sup> RXP and RXP AQ indicators are based on highly disaggregated trade data (six-digit Harmonized System classification) from UN ComTrade data, enabling unit values to be interpreted as prices of trade flows. As described by the authors, “the “euro per kg” definition refers to changes in RXP given changes in relative export unit prices weighted by the importance of competitors and the elasticity of substitution. The “euro per unit of utility” definition accounts for changes in products variety and in the relative quality or taste preference. New variety (additional exporters of a product) decreases the market power of each exporter and increases consumers’ utility. The calculation of relative quality or consumer’s taste refers to unobservable factors but is derived from the utility optimization problem, considering relative prices, volumes and the elasticity of substitution between varieties. If the quality or taste preference for a country’s exports rises faster than in its competitors, the contribution to the RXP AQ index is negative, signaling an improvement in non-price competitiveness.

<sup>44</sup> Market share of goods is obtained through the difference between Portuguese exports and its external demand. Data for external demand calculated by GPEARI using a sample of 46 countries and data from the Winter Forecast 2017 weighed by the relative importance of each country on nominal exports of goods. Sample cleared of outliers. Together, this 46 countries compound more than 90% of Portuguese exports destinations. Terms of trade is defined as the ratio of the exports’ deflator by the imports’ deflator.

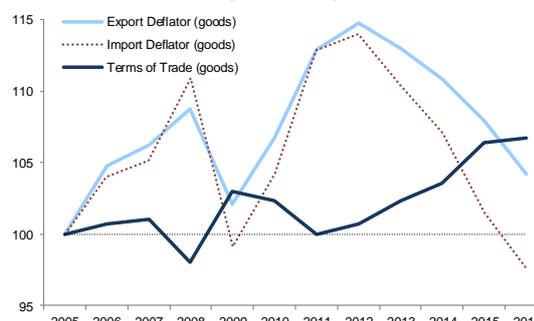
particularly since 2011, suggesting that these market share gains were not due to cost competitiveness factors (Figure 48).

**Figure 47 - Market share of goods**  
(2005=100)



Source: Statistics Portugal, EC and authors' own computations

**Figure 48 - Terms of trade for goods**  
(2005=100)



Source: Statistics Portugal and authors' own computations

This is also in line with results from a decomposition of the changes in market shares, using the methodology developed by CompNet, which relies on detailed product level data from UN Comtrade (ECB, 2015; Benkovskis and Wörz, 2014). By applying the Armington (1969) theoretical framework, the methodology allows disentangling the contribution of the intensive and extensive margins. The extensive margin captures the importance of new products and geographical destinations to a country's export developments, while the remaining is explained by the intensive margin, capturing the growth in a country's exports derived from traditional markets. The intensive margin is further decomposed in four components<sup>45</sup>:

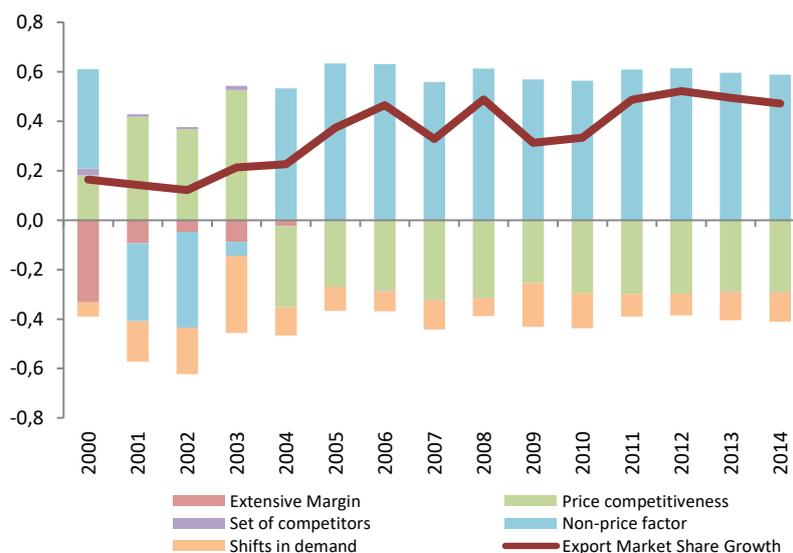
1. Price competitiveness: reflects the impact of changes in a country's export prices relative to prices of competitors (those exporting the same product).
2. Set of competitors: evaluates the market share of suppliers that are present on a market in two consecutive periods. An increase in competition among suppliers negatively affects a country's export market share.
3. Non-price factors: residual between changes in export market shares and the contribution of items 1 and 2. It captures any change in market shares that is not explained by price and cost factors. Can be interpreted as shifts in consumer tastes or changes in quality.
4. Shifts in demand: explains changes in market shares that are not due to particular geographical destinations but rather to world market. Accounts for the different import growth rates between individual countries that differ according to demographics, savings rate and economic structure.

By analysing the composition of export market growth for goods (Figure 49), it is clear that non-price factor played a major role, more than offsetting losses in price competitiveness and negative shifts in demand<sup>46</sup>.

<sup>45</sup> Unlike the case of intensive margin, the driving forces behind extensive developments cannot be ascertained without additional information (namely, firm-level data).

<sup>46</sup> The sum of the abovementioned components differs slightly from the total growth in export market shares due to log-linearization and missing data on unit values.

**Figure 49 - Portugal export accumulated market share growth, nominal terms**



Source: CompNet Diagnostic Toolkit for Competitiveness

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## Annex A - Evolution of selected indicators of structural reforms

International organizations produce a rich set of cross-country comparable indicators on different structural dimensions. The most widely used refer to regulations in product and labour markets (OECD) and the business environment (World Bank and World Economic Forum). The indicators are necessarily partial and fail to fully capture the relevant structural dimension. Also, some of them provide *de jure* and not *de facto* measures of performance. Comparability across countries is also limited, given the use of perceptions data (instead of hard data on performance) and the complexity of the underlying sources (e.g. the OECD PMR indicator is derived from a set of around 900 questions, replied at national level by different authorities and with a certain degree of subjectivity). Despite their limitations, the structural measures provide an indication of the country's stance and of the evolution across time.

Concerning the OECD **product market regulation** indicators, Portugal is clearly a top reformer in the past years, being in 2013 (the latest period for which data are available) below the OECD average (Figures A1 and A2)<sup>47</sup>. The progress was not only considerable but also broad-based, along the three dimensions of the indicator: state control, barriers to entrepreneurship and barriers to trade and investment. Sectoral regulation was also significantly relaxed, in particular for networks and retail trade (Figure A3 and Table A1).

**Employment protection legislation**, measured by the OECD indicators for regular and temporary contracts, was also significantly reduced, in particular after 2007, with values that are now much closer to the OECD average (Figures A4 to A6). The reduction for regular contracts was larger, reducing the gap between the two types of contracts.

In terms of the **business environment**, the Doing Business indicator from the World Bank shows that Portugal has been consistently reducing the distance to the frontier (DTF), with particularly good performance in areas such as starting a business or trading across borders (Figures A7 and A8). DTF results for Portugal are in line with those for the OECD high-income countries (77.5 v. 76.8 for Portugal; frontier=100). The good position is corroborated by the Global Competitiveness Index from the World Economic Forum, where the Portuguese performance is broadly in line with that of Europe and North America (Figure A9).

The positive **impact on growth** of the developments depicted by the above indicators is well documented in cross-country studies (e.g. IMF, 2015 and 2016; and Égert and Gal, 2016) and is corroborated by research conducted for Portugal (Gouveia, Santos and Gonçalves, 2017; Monteiro and Gouveia, 2017; Correia and Gouveia, 2017). For employment protection legislation, a word of caution is needed as the literature is not conclusive (see OECD, 2007 for a review of the literature). Indeed, an appropriate assessment of the labour market framework must take a more encompassing view, for instance including information on active labour market policies, the labour tax wedge and unemployment benefits.

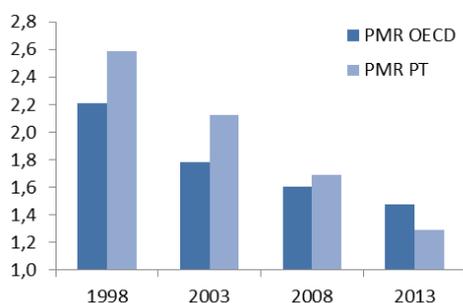
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<sup>47</sup> Lower values of the indicator correspond to lower regulation.

## Product Market Regulation data

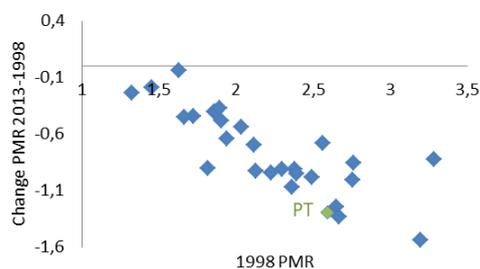
Note: The indicator ranges from 0 to 6 with 0 being the least restrictive setting.

Figure A1 - Product Market Regulation indicator



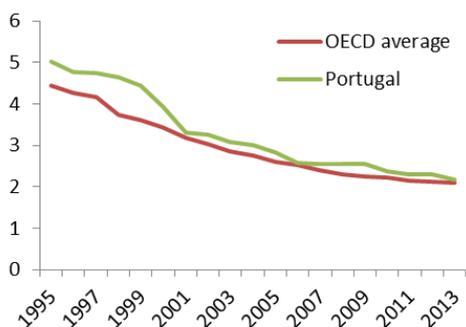
Source: OECD

Figure A2 - Product Market Regulation – change 1998-2013



Source: OECD and authors' own computations.

Figure A3 – Sectoral Regulation indicator - overall



Source: OECD

Table A1 – Sectoral Regulation indicator – by sector

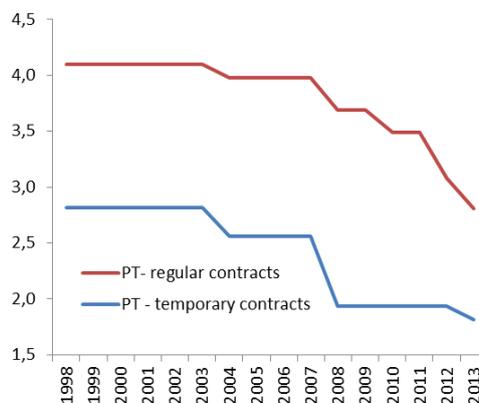
Sectoral regulation		1998	2003	2008	2013	Change 2013-1998
Networks	OECD	3,7	2,9	2,3	2,1	-1,6
	PT	4,6	3,1	2,5	2,2	-2,5
Retail trade	OECD	2,7	2,3	2,2	2,0	-0,7
	PT	3,5	3,3	4,0	1,8	-1,6
Professional services	OECD	2,3	2,2	2,1	2,0	-0,1
	PT	.	.	3,1	2,9	-0,2

Source: OECD and authors' own computations.

## Employment protection legislation data

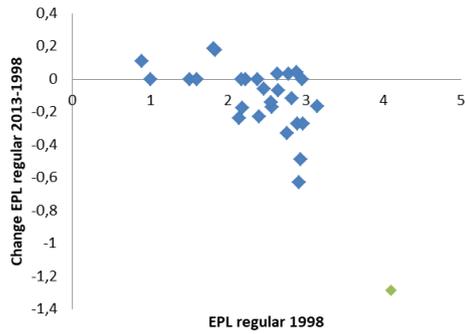
Note: to allow for a longer time series, the versions of the indicators used in the charts are "version 2", as published by the OECD. A more complete version (version 3) is also available but only from 2008. Please refer to the OECD webpage for further details. The indicator varies from 0 to 6, with 0 being the least restrictive setting.

Figure A4 – Employment protection legislation



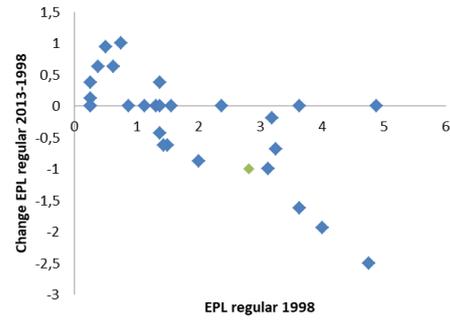
Source: OECD

**Figure A5 - Employment Protection Legislation indicator – regular contracts - change 1998-2013**



Source: OECD and authors' own computations.

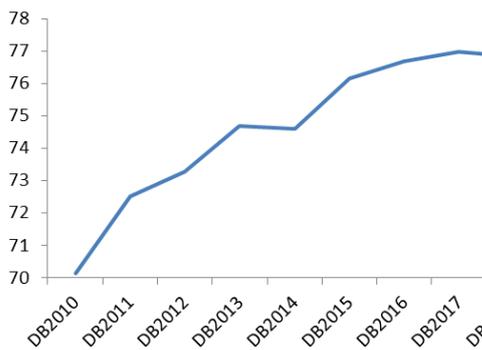
**Figure A6 - Employment Protection Legislation indicator – temporary contracts - change 1998-2013**



Source: OECD and authors' own computations.

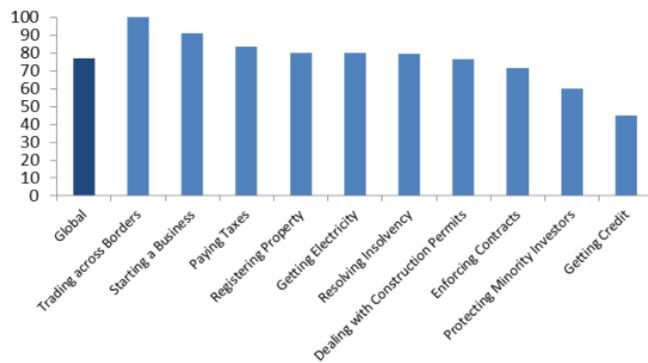
### Business environment

**Figure A7 – Ease of Doing Business in Portugal – distance to the frontier (=100) – overall evolution across time**



Source: World Bank

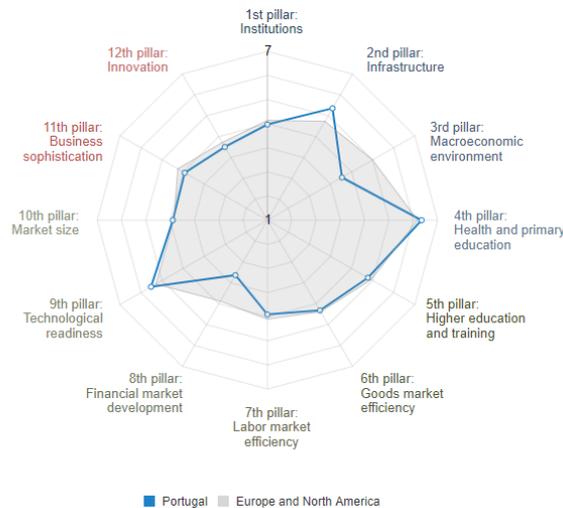
**Figure A8 – Ease of Doing Business in Portugal – 2018 edition distance to the frontier (=100) for the different dimensions**



Source: World Bank

**Figure A9 – Global Competitiveness Index 2017/2018**

Portugal vs. Europa and North America (1 worse, 7 best)



Source: World Economic Forum

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