

GEE Papers

Número 70

Junho de 2017

Portugal: a Paradox in Productivity

Ricardo Pinheiro Alves

Portugal: a Paradox in Productivity

Ricardo Pinheiro Alves ¹

Abstract

Portugal is experiencing a larger slowdown of productivity growth than the one occurring in advanced economies. This paper aims to help understanding why convergence in productivity levels is not happening by considering its main determinants. It presents a set of different reasons for this slowdown and divergence with developed economies since the mid-1990s that are associated with an increasing misallocation of capital, labour and skills both at a sectorial and firm level.

JEL Classification: H80, O40.

Keywords: Portugal, Productivity, Convergence

¹ Director of Gabinete de Estratégia e Estudos and Assistant Professor at Instituto de Arte, Design e Empresa – Universidade Europeia. This article does not necessarily represent the views of these institutions. I thank Andrew Sharpe and two referees for their invaluable comments and suggestions, and Guida Nogueira for research assistance.

1 - Introduction

Portugal is experiencing a slowdown of productivity growth, similar to the one occurring in advanced economies. Given that aggregate productivity growth is the main source of per capita income differences across countries, this slowdown is associated with a slower improvement in living standards.

Several explanations are possible: the birth rate of innovative firms able to deal with higher regulatory complexity and thrive is declining (OECD, 2015a); Insufficient investment in infrastructures, equipment, R&D and information and communication technology (ICT) in developed economies and associated with a weak aggregate demand (Sakellaris and Wilson, 2004; Jorgenson et al, 2008; Adler et al, 2017); Slower technology diffusion (Andrews et al, 2015); Non-competitive product markets and capital misallocation (Isaksson, 2007; Dias et al, 2016). Rigid labour markets and rapid ageing of the population in European countries led to skills and labour mismatches and insufficient knowledge-based and human capital accumulation (Bloom et al, 2012; Adler et al, 2017; Aiyar et al, 2016).

In a neoclassical world, Portugal, poorer than most of the developed economies, is expected to converge both in the level of productivity and in the average wealth of the population. That was the goal when Portugal became a European Community member.

The aim of this paper is thus to understand why the expected convergence is not happening. It starts by comparing the recent evolution of productivity in Portugal and the most developed countries, the EU core2 and G7, confirming that the Portuguese economy is diverging in productivity levels. Then, the main productivity determinants are considered in order to present some possible explanations for the slowdown in the Portuguese economy. It concludes with a brief review of the main findings.

2 – Evolution of Portuguese productivity

Aggregate productivity (AP) reflects the efficiency in producing in one country. In an aggregate production function, productivity growth can be complimentary measured through the change in labour productivity, or any other input, or in multifactor productivity.

Labour productivity (LP) measures units of output produced per unit of a labour input. LP growth reflects the gains from the use of the labour input and from multifactor productivity and capital, through its service per unit of labour. This same logic can be applied to capital or any other input. Multifactor productivity (MFP) measures the residual in economic growth. MFP growth reflects the increase in output that is not explained by a change in the quantity of inputs and it can be interpreted as the change in the stock of knowledge applied in production. If everything else is equal, countries with a lower stock of knowledge will tend to imitate those with a higher stock and thus to catch-up and converge.

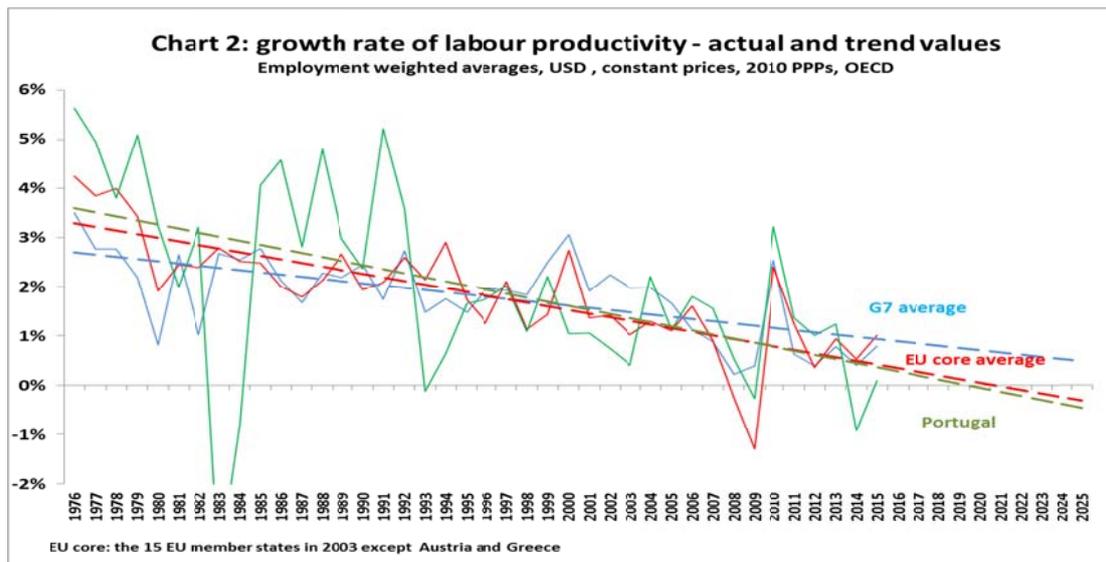
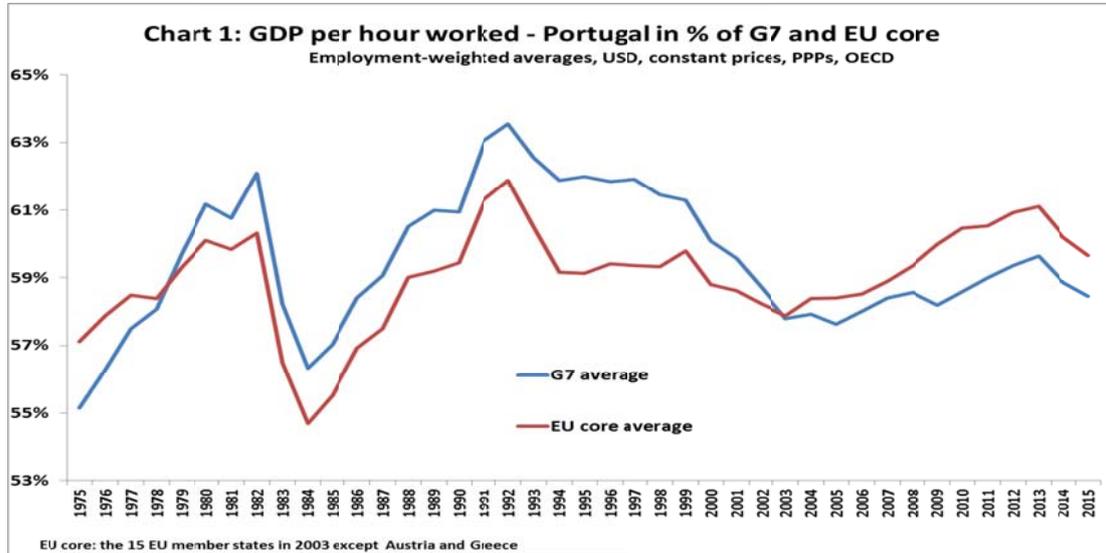
Portugal converged with developed economies in both LP and MFP growth after the transition to democracy in 1974 and until the 1990s. Improvements in the level of education and in the allocation of skills, a higher rate of investment in tangibles and important reforms after EC entry help explain it. But since then productivity growth slowed and Portugal started to diverge due to insufficient investment in ICT and R&D, labour market rigidity and the allocation of labour and capital to non-tradable industries³, partly dominated by state-owned firms or less open to competition. The evolution after the global financial crisis of 2008 is not clear.

² EU core includes all the member states in 2003 except Austria and Greece, for which there isn't data.

³ Tradable industries when exports/sales higher than 15%. Include agriculture, mining, manufacturing, transports, tourism, consulting and other technical activities. The remaining, including the state sector, are non-tradable.

2.1 - Labour productivity

Figures 1 and 2 below compare Portugal with employment-weighted G7, a proxy for globally developed markets, and the EU core averages, and show that LP grew faster in Portugal than in advanced countries up to mid-1990's. From 1975 to 1995, LP yearly average growth rate was 2.8% and the average income in Portugal increased faster than in the EU core countries.



Between 1985 and 1995 (Table 1), after severe economic problems associated with the second oil shock and when Portugal became member of the European Communities (EC), there was a catching-up and the LP yearly growth rate was significantly above the G7 countries (2%) and the EU core (2.2%). This higher growth is associated with the implementation of important liberalization reforms after the EC entry and improvements in human capital and a higher rate of investment that led to a higher capital-labour ratio (Freitas, 2012).

LP growth up to 1995 was also a result of better labour allocation. Employment started to move from agriculture and agro-food, textiles and other traditional industries to service sectors such as trade, utilities, construction, real estate, business services, financing or tourism, where there was higher productivity growth (Lains, 2008).

Table 1: GDP per hour worked* - yearly compounded growth rates

	1970-1980	1980-1990	1985-1992	1992-2000	2000-2007	2007-2015
Portugal	3,2%	2,2%	3,8%	1,5%	1,3%	0,9%
G7	2,9%	2,2%	2,2%	2,3%	1,7%	0,9%
EU core	3,8%	2,3%	2,2%	2,2%	1,2%	0,7%

Source: OECD. * USD Constant prices, 2010 PPPs. G7 and EU core: employment-weighted averages

G7: Canada, France, Germany, Italy, Japan, UK and USA. EU core: 15 members in 2003 except Austria and Greece

After 1993, however, LP growth started to progressively slowing down (figure 1), registering an annual growth rate of 1.2% up to 2014. As a consequence, LP in Portugal diverged up to 2003 with the EU core and up to 2007 with G7. Worse, Portugal was expected to grow faster in terms of LP but the underlying trend is of a tiny divergence with the EU core (seen only in the slashed lines), to whom is economically more integrated, and a stronger divergence with G7 (seen in the higher decreasing slope of Portugal and in the equations in figure 2).

Labour was allocated to smaller firms and non-market entities in trade and services sectors, which represented 72% of total employment. Non-structural factors such as deficient capital allocation to protected industries and to state-owned firms, distorted competition and rigid labour markets also explain the slowing down of LP (McKinsey, 2004).

Further trade liberalization with the creation of the World Trade Organization in 1995, reinforced by China's accession in 2000, the end of multi-fiber agreement and the EU enlargement to Central European countries in 2004, opened the European market for developing economies. It had two consequences for traditional exporting industries (textiles, footwear, pulp, etc.): a reduction in employment due to business closures, because lower relative wages were no longer a comparative advantage, and further improvements in LP in the remaining firms in these industries (Lains, 2008)⁴.

But LP gains in manufacturing were not sufficient. Overall LP divergence is evident since 1993, initially in trade and market services, and in the 2000's even LP growth in manufacturing became lower than in the EU core (Sondermann, 2012). Contrary to most developed economies, manufacturing was always a relatively small sector in Portugal in gross value added terms (GVA) because there was a direct transition of resources from agriculture to low LP growth activities such as construction, trade and market and non-market services.

A consequence of the low LP growth in Portugal, together with a higher increase in Portuguese real wages, the increasing consumption levels financed externally with Euro-related low interest rates and permanent deficits in the current account (Blanchard, 2007) was an almost unsustainable level of debt owed by families, firms and the Portuguese state that ended in a near-bankruptcy in 2011.

The relative level of LP recovered after 2007. Despite the important reforms recently introduced in the labour market and the catching-up in the level of education (section 3), it is difficult to know if this is sustainable. The stock of capital per person employed is decreasing since 2013 and recent employment growth is probably bringing back to the market some of the low skilled and less productive workers that became unemployed after 2000. If this is the case, and the latest available information up to 2016 seems to confirm it, it will negatively affect LP growth in the near future and confirm its decreasing trend.

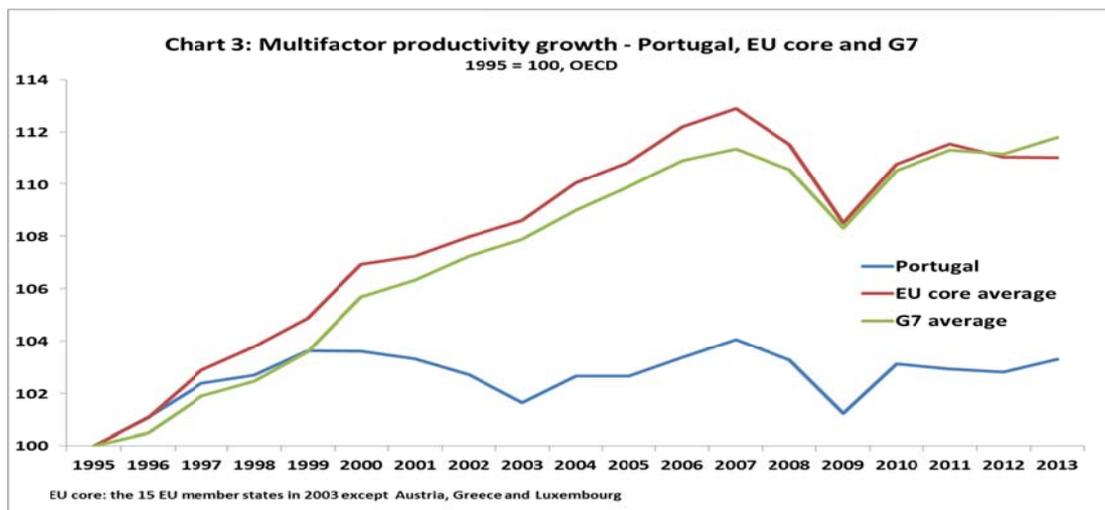
⁴ Bloom et al (2015) explain the same effects in 12 European countries with Chinese import competition after its accession to the WTO.

2.2 - Multifactor productivity

Multifactor productivity (MFP) growth was also higher in Portugal than in most of the remaining developed economies between the 1970s and the beginning of the 1990's. According to Eckaus (2008), the average yearly growth rate of MFP in Portugal was 0.4 percentage points higher than the EU core of 15 countries between 1975 and 1985 and 2.1 p.p. higher between 1985 and 1990. After 1990, the rate of growth decreased but it was still above the EU15 average by 0.2 p.p. in 1990-1995. Throughout this period MFP in Portugal also grew faster than in the USA and Japan.

Eckaus explained it with a catch-up from a very low base, improvements in human capital due to a double of the average years of education for working age population, new investment from foreign sources (private and EU funds) in non-traditional sectors in Portugal such as the car industry and in Information and Communications Technology (ICT). Liberalization reforms after the entry to the EC in 1986 most probably helped.

However, MFP growth slowed in the end of the 1990s⁵, falling below that of the G7 and EU core countries (Figure 3 and table 2). Multifactor productivity grew by 0.2% between 1996 and 2013 (yearly average) and did even worse than LP because it stagnated since 1999. Portugal was not converging in MFP with most of the remaining advanced countries.



**Table 2: Multifactor Productivity
yearly compounded growth rates**

	1995-2000	2000-2010	2010-2013
Portugal	0,7%	0,0%	0,0%
EU core*	1,3%	0,4%	0,1%
G7	1,1%	0,4%	0,3%

Source: OECD.stat

* EU core (the above EU countries and Belgium, Denmark, Finland, Ireland, Spain, the Netherlands and Sweden). Unavailable data for Greece, Austria and Luxembourg.

Balta and Mohl (2014), using a different methodology, explain the TFP-based technological gap between advanced and “laggard” economies (Portugal, Spain and Italy) within the Euro area to widen or to be persistent (depending on the industries) in the decade preceding the global financial crisis. In some non-tradable industries (utilities, construction and some services) that grew substantially in Portugal during

⁵ From this point on these are OECD numbers, while those presented in Eckaus (2008) are EC's.

this period there was even negative MFP growth partly due to insufficient investment in R&D and ICT, or, during the crisis, due to capital misallocation (Gopinath et al, 2017).

The insufficient investment in intangibles is consistent with the consumption-based model of economic growth in Portugal after 1995. An external inflow of money associated with low interest rates from Euro membership, together with wage growth in non-tradable sectors, led to growing consumption levels that deteriorated the current account and to a substantial increase in external debt. Resources were misallocated to non-tradable and protected industries (wholesale and retail trade, state services and construction weighted more 10 p.p. in total GVA than in the Euro core countries), where MFP declined, and total investment was not revved up by the surge in domestic demand (Reis, 2013).

2.3 – Distributional features

The productivity growth slowdown is associated with a widening dispersion of productivity gains in each sector and with higher wage dispersion (Berlingieri et al, 2017; Andrews et al, 2015). Neo-Schumpeterian growth theory states that firms at the frontier are able to innovate and adopt new technologies and knowledge, thus keeping a higher annual rate of productivity growth. The remaining firms, however, may face a slowdown in productivity growth when there are frictions in technology and innovation diffusion through learning or catching-up.

This is observed in many markets where the effects of digital technologies and globalization led to winner take-most dynamics and is more pronounced in industries where recent product market reforms were less pro-competition, suggesting that policy decisions are limiting the diffusion process. (Andrews et al, 2016).

A question, then, is if this is happening in Portugal. Figure 4 and 5 are based on the OECD’s Multiprod output and show the sectoral evolution of the standard deviation of LP and MFP growth rates between 2004 and 2012. In most industries a stabilization or a reduction in the dispersion can be observed. The dispersion of LP growth rates in the manufacturing sector has increased but that was not the case for MFP.

The standard deviation at a 3-digit industry also shows stability in the degree of dispersion. Exceptions include an increase in the standard deviation (pharmaceutical products, chemicals, wood and paper, rubber and plastics, electrical equipment, furniture, accommodation and food services, Legal and accounting, Advertising and market research) or a decrease (Computer, electronic and optical products, Publishing, audiovisual and broadcasting activities, IT, Electricity and gas, real estate, telecommunications).

Chart 4: Dispersion of LP growth rates

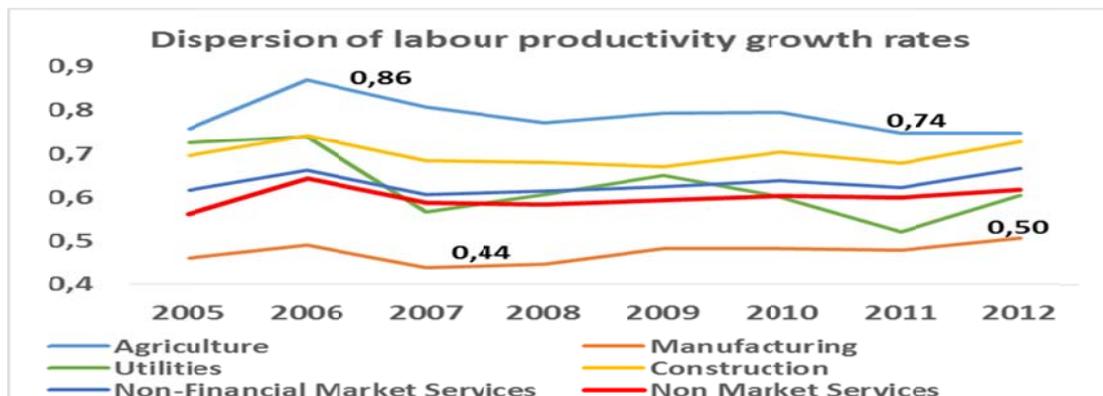
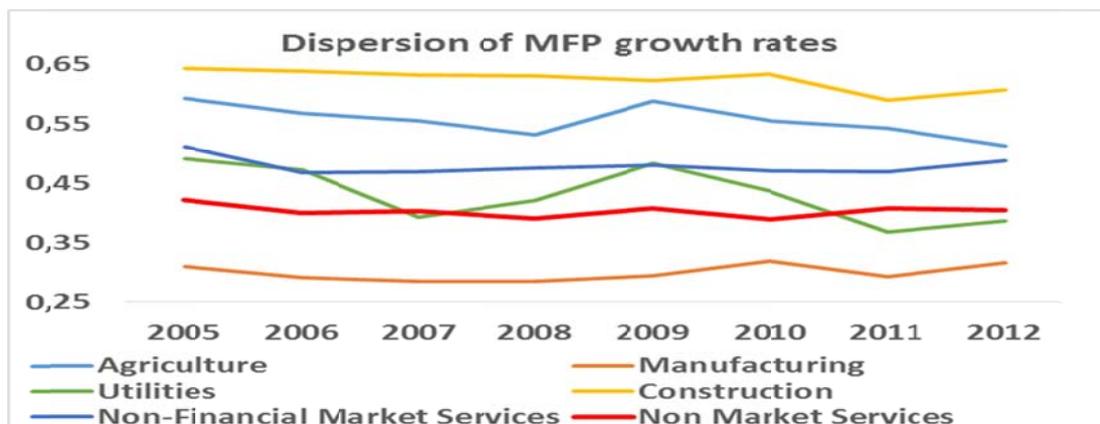


Chart 5: Dispersion of MFP growth rates



Source: based on OECD's Multiprod output⁶. MFP computed as a Solow residual.

An explanation would be that, in global terms, none of the Portuguese firms are at the global frontier and the data only compares firms at the national frontier with the laggards, where productivity convergence seems to be easier (Bartelsman et al, 2008). However, many Portuguese firms are integrated in global value chains and are either leading their specific field (e.g. Amorim for cork appliances in aerospace industry, CGC genetics or Via Verde for road tolls) or in multinationals where higher productivity levels justify the operation in Portugal.

Moreover, Santos et al (2017) present evidence of spillovers from recently introduced structural reforms in the business environment and product markets that impact MFP at a firm level. These spillovers are both of diffusion from the frontier through learning and innovation by laggards and of catching-up by other firms via the adoption of existing technologies or imitation of production processes.

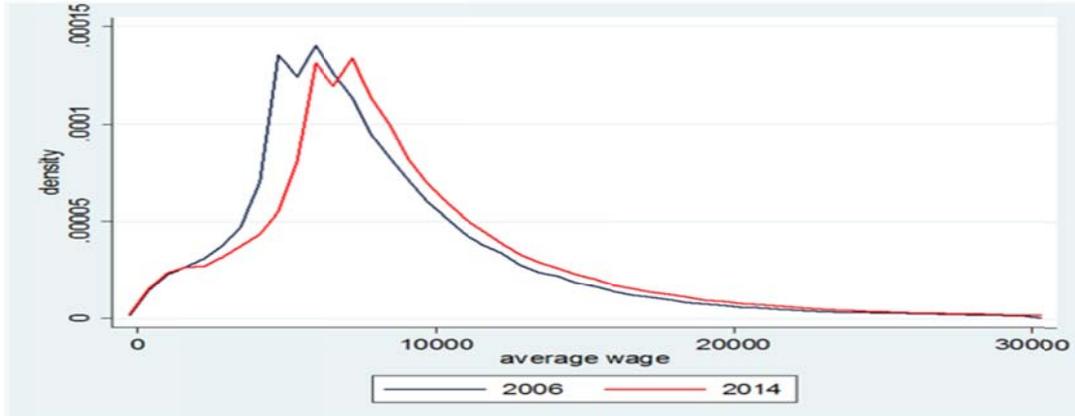
The stability in dispersion, then, may be due to a low number of Portuguese firms connected to GVCs, namely SMEs which account for 99% of total firms. These are benefiting for the diffusion and catching-up mechanisms but most of the Portuguese firms are not. This is consistent with the low competitive pressure in some product markets exposed in section 3.4 below.

A second consequence at the OECD level was higher wage dispersion due to skill biased technology enhancements, resulting in a job polarization where middle income workers lose their jobs due to the delocalization of firms for other parts of the world, searching for a similar-skilled workforce at a lower cost.

Figure 6 shows the distribution of average wage in private firms to improve between 2006 and 2014. Table 3 presents different measures of dispersion that confirm lower wage dispersion. The ratio between the percentiles 90 and 10 slightly increased in some sectors (agriculture, market services, construction) but decreased in others (manufacturing, utilities). The increase was fully explained by the evolution in the ratio between middle and low-wage workers (50 and 10), given that there was a decrease in the dispersion between wages in the percentiles 90 and 50. Moreover, Gini coefficients decreased in all sectors except in Mining.

⁶ Market Services: Wholesale and retail trade, transportation and storage, accommodation and food services, Publishing, audiovisual and broadcasting, telecommunications and IT; Real estate, Legal, accounting, head offices and management consultancy activities, technical, testing and analysis, advertising, market research, veterinary and administrative service activities, education, human health, repair of computers and household goods.

Chart 6: Distribution of the average wage in Portuguese firms – 2006 and 2014



Source: IES, firm level data

Table 3: Dispersion measures of average wage (per worker)

Sectors	90/10 (2006)	90/10 (2014)	90/50 (2006)	90/50 (2014)	50/10 (2006)	50/10 (2014)	Gini Coef. (2006)	Gini Coef. (2014)
Agriculture	4,41	4,46	1,91	1,83	2,31	2,43	0,32	0,31
Mining	3,62	3,79	1,86	1,80	1,95	2,10	0,29	0,30
Manufacturing	3,17	3,12	1,88	1,82	1,69	1,71	0,29	0,27
Utilities	5,82	5,12	2,40	2,35	2,43	2,18	0,42	0,40
Construction	3,88	4,09	1,95	1,91	1,99	2,14	0,33	0,31
Market Services	4,64	4,66	2,23	2,17	2,08	2,14	0,36	0,35
Total	4,24	4,41	2,12	2,06	2,00	2,14	0,34	0,33

Source: IES, firm level data

Therefore, it seems that distributional effects of the slowdown in productivity growth in Portugal do not match those presented by the OECD. Lower productivity growth in Portugal is neither associated with a dispersion of productivity gains between firms in the same sector nor with higher wage dispersion between high and low skilled workers due to skill biased technology enhancements. A consequence is that it is not desirable that public policies towards productivity should be limited beforehand by equality concerns, as sometimes it is argued (OECD, 2016).

The difference between the Portuguese case and the OECD thesis may arise from the economic crisis, when there was a huge increase in unemployment but wage moderation policies were highly progressive (OECD, 2017a). There was an increase in income inequality explained by higher unemployment (peaked at 17.5% in the 1st. quarter of 2013) but not due to wages given that average earnings for the total economy became more equal. The S90/S10 ratio decreased from 7.1 to 6.4 between 2006 and 2013 (Arnold and Rodrigues, 2015).

Indeed, it was low wagers, young and less-skilled workers, who were more affected by the increase in unemployment rate since 2000 and by the worsening of economic conditions that followed the 2008 financial crisis and the near-bankruptcy of 2011.

3 – Productivity determinants

A way to understand the slowing down of productivity growth in Portugal is to consider the determinants of LP and MFP growth. Syverson (2011) reviews the productivity literature and presents evidence of very significant effects on aggregate productivity from physical capital of quality, intangible investment in information technology, R&D and innovation, and human capital accumulation. Moreover, the business environment can affect firms' incentives to apply the above factors to raise their own productivity level through a better resource allocation from higher product market competition and knowledge and technology spillovers. Gonçalves and Martins (2016) broadly confirm these determinants for Portuguese manufacturing firms.

Some of the determinants have recently registered a positive evolution – investment in R&D, ICT capital growth, formal education, birth rate of new firms or increasing integration on global markets. Thus, other reasons must explain why Portugal is not converging in terms of productivity.

3.1 - Investment in equipment and infrastructure

Portugal benefited from a huge inflow of foreign capital after the EC entry and when the European Monetary Union was on the making and resulted in an increase in the net stock of capital per person employed (figure 7). This included both private and official EU funds, and purely financial and FDI flows. According to OECD data, the inflow was reflected by an average yearly compounded growth rate of capital intensity⁷ in Portugal of 4.6% between 1995 and 2013, significantly above the EU core (2.7%) and G7 (2.4%) averages.

However, this growth in capital intensity was accompanied with a decrease in both the LP and the MFP growth rates (section 2). Capital services from this inflow were not of a sufficiently “high quality” nature to have a significant positive impact on productivity (e.g. Sakellaris and Wilson, 2004). Figure 8 shows a fall in capital productivity⁸ growth in Portugal since 1995 more pronounced than in all G7 countries.

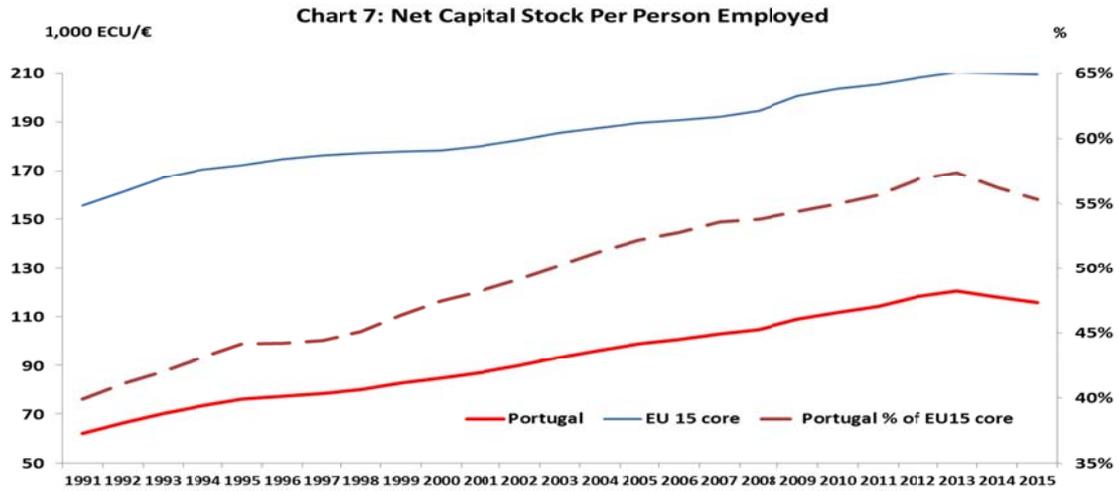
The unproductive use of capital in the Portuguese economy is also confirmed by the decreasing, almost to nil, capital per worker contribution to trend labour productivity growth (adjusted for cyclical effects) in Portugal between 2000 and 2015 (Ollivaud et al, 2016).

The weak effect of this capital inflow in productivity is unexpected due to the low relative level of capital per worker in Portugal, well below that of the EU15 core countries (Figure 10). But capital misallocation and excessive consumption of imported goods and services explain it.

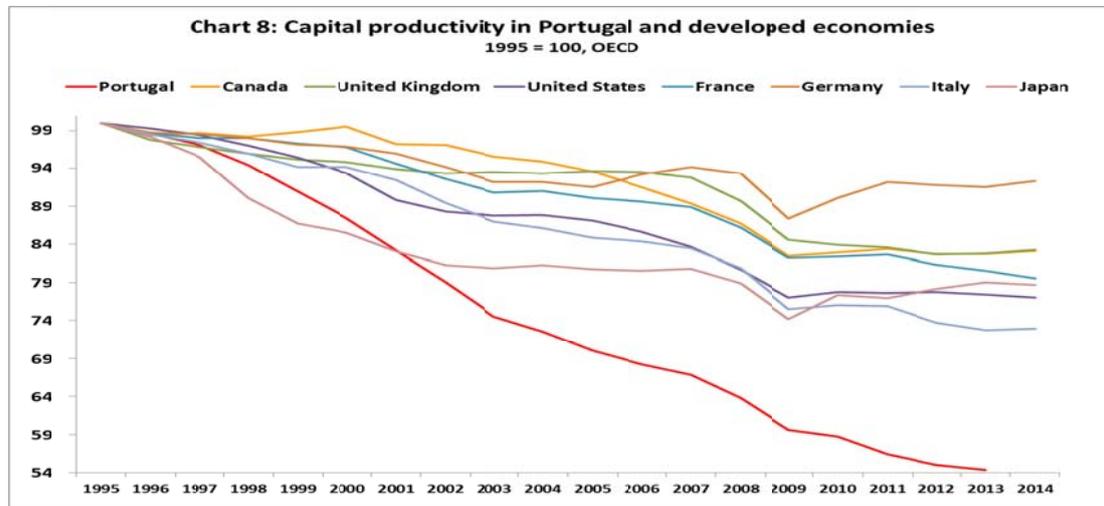
A between-sector misallocation of capital since the 1990s can be seen in the growth of non-tradable sectors and in investment in infrastructure and housing. Reis (2013) hypothesizes that the financial integration after 1995 was not reflected by financial deepening in the tradable sector but via the expansion of less productive private and state firms in the non-tradable sector.

⁷ Capital intensity is the ratio of capital services (the flow of productive services that capital delivers in production) per hour worked.

⁸ Capital productivity is measured as the ratio between the volume of GDP and the volume of capital input, defined as the flow of capital services. Capital services are estimated by the OECD using the rate of change of the productive capital stock, which considers the reduction in the productive capacity of fixed capital assets. A common computation method for all countries ensures comparability.



Source: AMECO. Note: Net capital stock at 2010 prices per person employed; total economy; 2014 - 2015: provisional data.



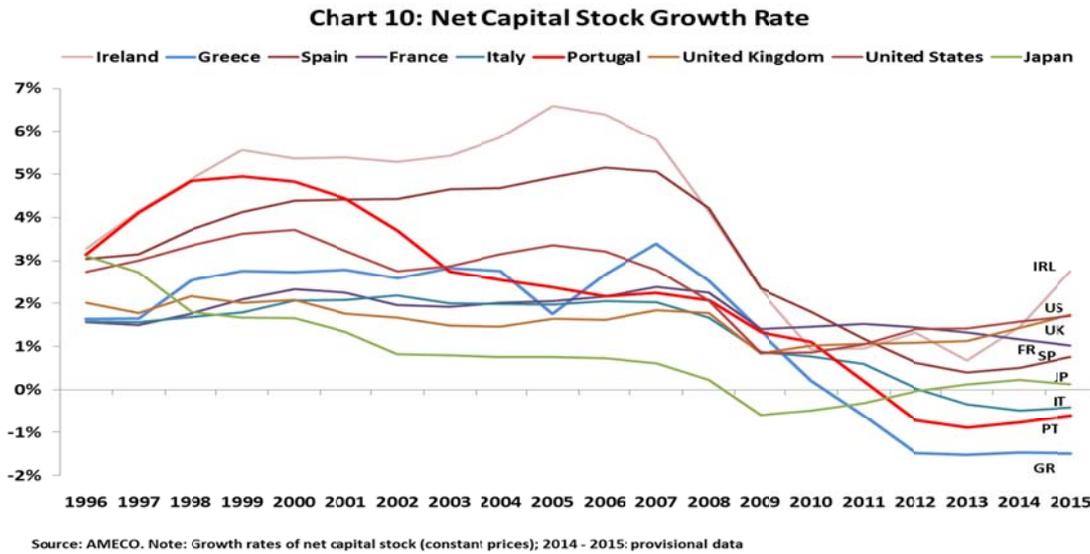
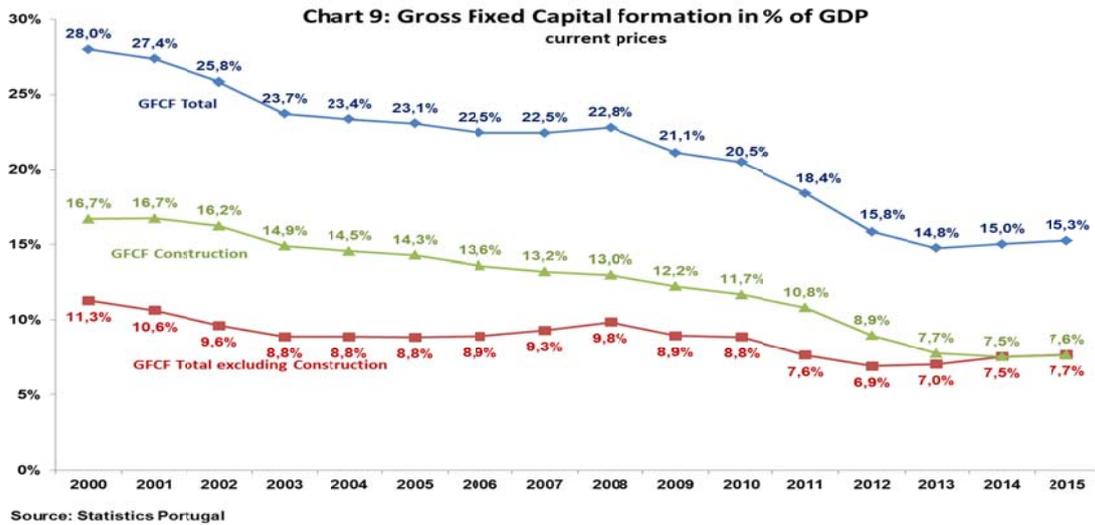
Indeed, a significant part of capital was channeled to state and/or protected industries such as wholesale and retail trade, real estate or construction, which registered higher profits but lower LP growth (OECD productivity indicators). Tradable sectors with higher productivity growth, such as traditional manufacturing industries, faced a downsizing due to European integration and international trade liberalization.

Moreover, there was a lot of investment in infrastructure and housing during the 1990s, when the stock of capital in construction was 257% of GDP while the stock of vehicles and other equipment was only 78% of GDP. This difference, although partially reflecting the longer life-time of construction, shows that investment in Portugal was too concentrated. Construction also represented 11.5% of total employment in 2000, well above the EU core countries (6.2%).

Even when capital inflows started to slow down after 2000, new investment in construction still represented 60% of the total (Figure 9), well above other EU countries and despite the doubtful economic (but not the political) rationale. For example, part of a third highway between Lisboa and Porto (urban areas with 2.8 and 3.6 million people, respectively) was built, when the second complete highway had a very low level of traffic. Many road investments were made under badly negotiated public-private partnerships where the risk was entirely on the side of the Portuguese state. Investment in housing led to a situation where 5 million residential houses existed for a population of 10 million but because the rental

market is not working since the 1970s a lot of houses are degraded. Most of the investment was in new houses in city outskirts and not in refurbishing the old ones in city centers.

These frivolous policy decisions contributed to a rapid increase in the level of Portuguese debt but had low influence on productivity growth. The construction boom was financed by the banking sector leading to a credit misallocation that still exists today. Despite being the hardest industry affected after 2008 and its very low profitability, construction still remains the largest industry measured by bank loans (17% of the total), with the highest non-performing rate, 28% (IMF, 2015).



Finally, excessive consumption associated with an aim to reach better living standards is seen by the financial flows coming from abroad that were channeled through the banking system to import goods and services such as cars or tourism. These flows were reflected in an average deficit of 8.4% of GDP in the Portuguese current account during the decade of 2000.

An increasing bad allocation of capital via an over-focus on non-tradable sectors (OECD, 2017b) and bad investment decisions in infrastructure and housing when capital was abundant, together with a low level of capital per worker and a recent financing constraint to the whole economy where investment growth is below the level needed to replace the capital stock (figure 10), has been and still is a very important bottleneck to productivity growth.

3.2 – R&D, ICT and innovation

Portugal increased the level of expenditure in Research & Development (% of GDP) up to 2010. Gross domestic expenditure on R&D in Portugal was 1.3% of GDP in 2014, up from 0.7% in 2000 and the number of researchers per thousand employed is now higher than in the OECD or the EU28 (Figure 11). Moreover, and according to the OECD, Information and Communication Technology (ICT) capital services per hour worked grew an average of 11.3% between 1995 and 2013, above that of the UK, the US or Japan.

Furthermore, Portugal is seen as a moderate innovator and is ranked 18th in the European Innovation Scoreboard 2016 (EIS), presenting an innovation performance only slightly below the EU average. In the mostly perception-based Global Competitiveness Report 2015, Portugal ranks (in 140 countries) well in some indicators: Technological readiness 26th (32nd in 2008); Innovation 28th (35th in 2008); Availability of scientists and engineers 21st (48th in 2008); Availability of new technologies 18th (28th in 2008); Quality of scientific research institutions: 21st (33rd in 2008);

These are the outcome of public policies aiming to increase the stock of knowledge produced in the Portuguese scientific community. However, they did not materialize in higher LP or MFP growth because these policies led mainly to non-market dominated research. R&D is still too concentrated in the state sector, mainly in universities, and is mostly of a fundamental and not of an applied nature (Heitor et al, 2014). For example, universities filed for one third of national patents since 2010.

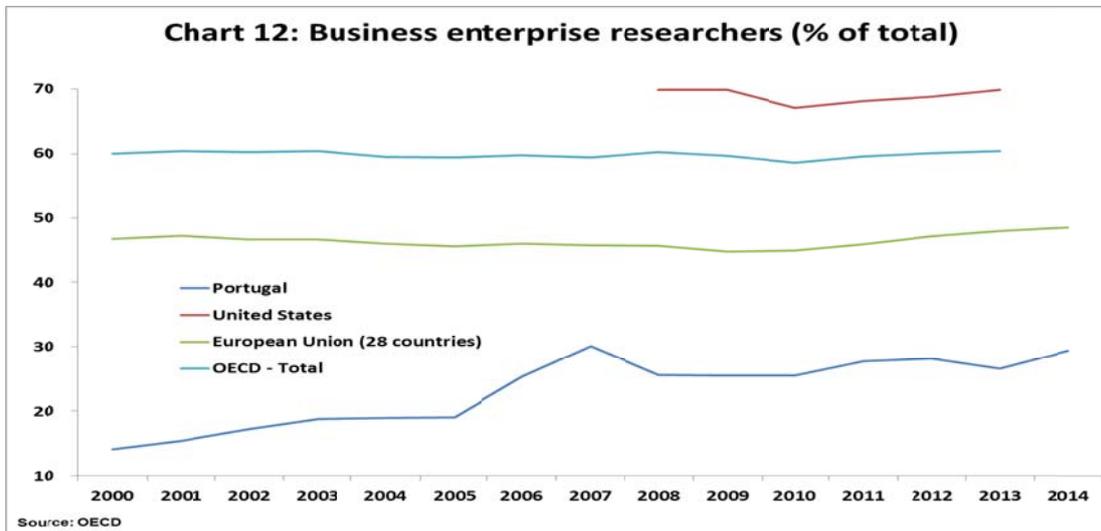
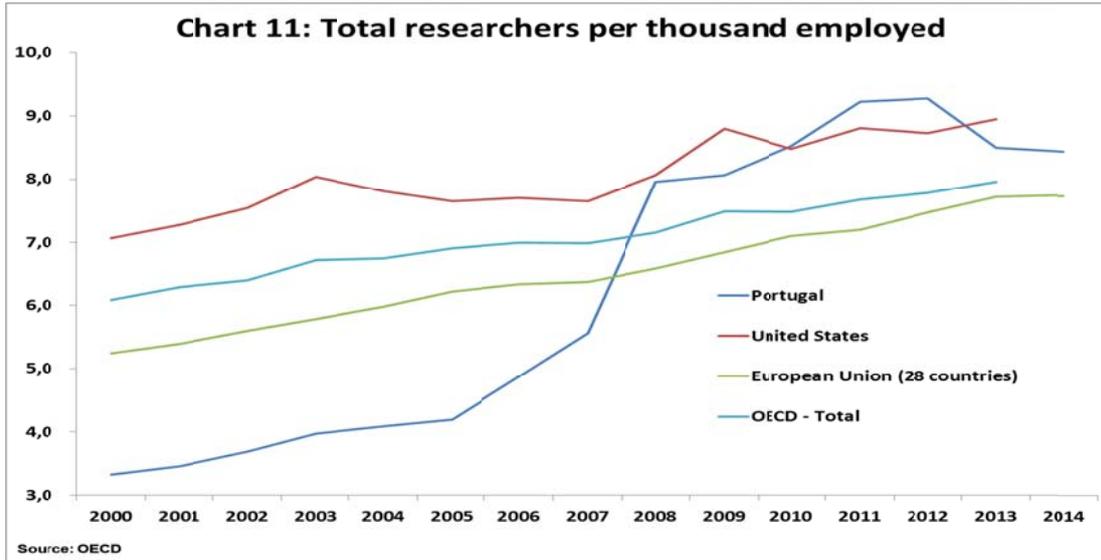
The rankings mostly reflect the level of expenditure but do not consider the efficiency or the market usage of these investments. Business oriented policies were based on tax credits and subsidies to investment in R&D and innovation. But these were insufficiently evaluated, were partly destined to non-tradable industries and achieved a limited success. Other policy efforts, such as the placement of PhDs in firms, failed.

Investments in intangible capital such as information technology, R&D and innovation benefit productivity growth through the improvement of production processes and better products and services ((Jorgenson et al, 2008; Balasubramanian and Sivadasan, 2011). Furthermore, they may originate productivity spillovers through the diffusion of innovation knowledge (Gersbach and Schmutzler, 2003) and technology transfer (Bloom et al, 2007) from firms in the global or national productivity frontier. The question is in what degree did this happened in Portugal?

The low number of researchers, the low total expenditure or the low number of patent applications by Portuguese firms indicates that these positive effects on productivity growth were limited.

The number of researchers that work in businesses are still half of the OECD average or the USA, and 60% of the EU28 (Figure 12). In a similar way, expenditure on R&D in Portugal is almost half of the OECD average (2.4% in 2014). Business expenditure on R&D in % of the total is growing (from 28% in 2000 to 50% in 2014) but partially due to lower state spending. It still is below that of developed economies (the OECD average is almost 70%).

Patent applications per 1,000 researchers are also too low, being in Portugal one tenth of the OECD average. The number of Portuguese patent applications filed under the Patent Cooperation Treaty (priority year) per 1,000 researchers (FTE) was 4 in 2014 (2 in 2000), but well below the OECD average: it grew from 31 to 38 between 2000 and 2014.



R&D and innovation resources were excessively allocated to non-market sectors, significantly limiting the potential positive effects on productivity growth. Significant incentives were destined to increase the stock of theoretical knowledge but were not sufficient in getting more efficient and innovating producers to replace less efficient ones, exposing a lack of coordination between science and innovation policies (3.4 below).

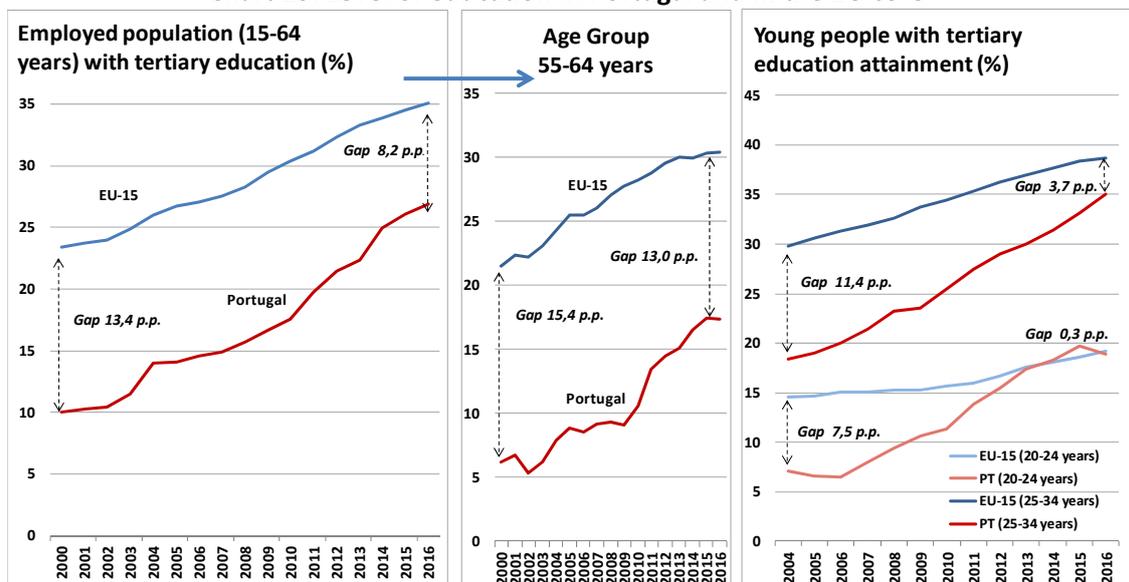
The small number of medium and large firms with financial strength for long term investment and the relatively large share of firms in services, where R&D and technology are less important, help explaining why a growing share of incentives were channelled through the state sector and not via businesses. Portugal needs to improve the market orientation of R&D and to evaluate public policies.

3.3 - Human capital accumulation

Portugal is rapidly converging with the EU15 average in formal education (figure 13). The gap on the workforce with tertiary education was reduced by 5 percentage points in the last 15 years (to 8.2 p.p.). In secondary education, Portugal has now 12 years of formal education that is legally binding and the recent results of PISA and TIMSS tests seem to show that this convergence is not only a question of numbers but also of knowledge.

However, this convergence in formal education coincided with the slowing down of productivity growth, where Portugal diverged with developed economies. Human capital accumulation originating from improvements in formal education or training policies is expected to accelerate LP and MFP growth (Fox and Smeets, 2011). In the case of Portugal it was not sufficient, and three possible reasons may explain why: wasted resources, non-aligned incentives and insufficient policy evaluation.

Chart 13: Level of education in Portugal and in the EU core *



Source: Employed Population (Labour Force Survey - Eurostat). EU core: 15 member states in 2003

Primary and secondary school in Portugal are still too centralized and schools have low autonomy. Financing is too dependent of the state and is not associated with school performance. Real expenditure grew by 33% since 2008, the largest increase among OECD countries except Turkey⁹. Because the number of students fell by 6%, the growth in expenditure per student was even higher. Overall, Portugal has spent 6.1% of GDP in education in 2013 (4.6% in 2008), above the OECD average of 5.2%.

This increase would be justifiable if the goal was to improve education for workers aged 55-64, where the gap in education is wider and long-term unemployment is concentrated. But this seems not to be the case because only 0.3% of adults with more than 25 years old were enrolled in upper secondary education in 2014.

Training and vocational programs oriented for the needs of employers improve skills of employees and managers and help the unemployed re-enter the labour market. But the effectiveness of these policies varies a lot and has room for improvement. The number of graduates in vocational programs is growing fast although it is still below the OECD average. In 2014, 41% of 25-34 years-old with upper secondary education had graduated from a vocational program, below the OECD average of 59% (OECD, 2015b). Their employment rate was around 80%, indicating a good level of effectiveness.

Training policies benefited from a recent attempt to increase on-the-job training and to integrate employers and other stakeholders in their design. But although Portugal received financial support from the EU in the last 30 years for these policies, their use was seldom duly evaluated, often resulting in a waste of resources with no sustainable effects for the beneficiaries.

⁹ OECD Education at a Glance, 2016.

Non-aligned incentives do not help. Education funds are allocated to the ministry of education while vocational and training funds are divided between education and the labour ministry. In practical terms, several government branches compete for these centrally managed funds, presenting a long and often confusing range of policy measures and programs. Moreover, both unions and employers saw frequently EU funds as a way to finance their activities and governments usually felt obliged to spend them to avoid the idea of not taking advantage of their availability, independently of the expected return.

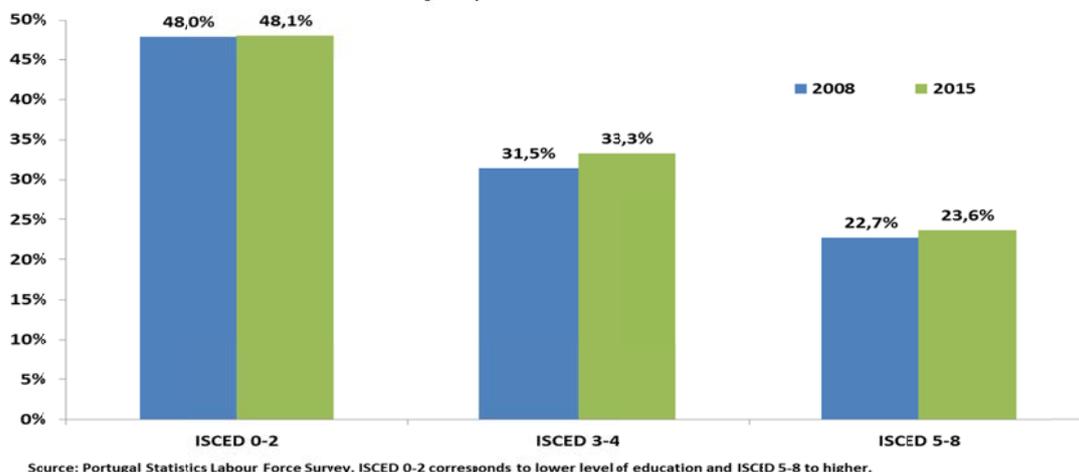
A second point is that employment-friendly labour market institutions facilitate a better matching between supply and demand. Despite recent improvements - the reduction in the regulatory differences between permanent and temporary contracts and in severance payments, and a review of the definition of fair dismissal (OECD, 2017a) - Portugal still is the OECD country with the strictest employment protection legislation in individual dismissals (OECD, 2017b).

Furthermore, Portugal's is a three tier labour market with two important segmentations. The first almost shelters two thirds of the labour force, permanent employees, from the danger of unemployment, while the others are under short-term contracts or as free-lancers, with weaker incentives for training. The second divides public employees, with a better-paid (it may reach 14% more after adjusting for qualifications, according to Mercer, 2013) job-for-life guarantee, from private employment.

These two segmentations progressively benefited non-tradable sectors, more sheltered from competition and with lower productivity growth, attracting employment from manufacturing and better-paid skilled workers. Figure 14 shows tradable sectors still too dependent on low-skilled workers while high-skilled ones are mostly on non-tradable industries. The growth of these sectors led to a misallocation of labour and skills thus hampering LP and MFP growth.

The recent improvement in formal education may also empower Portuguese firms with better-skilled managers. However, it does not necessarily affect all firms. Bloom et al (2012, 2014) show that manufacturing firms in Portugal have one of the lowest scores in management practices, associated with weaker market competition, more regulated labour markets and lower worker skills and conclude that management explains a very significant share (up to half of it) of MFP differences across countries. Moreover, managers in state-owned companies or business owners still tend to centralize decisions more frequently thereby preventing changes from workers' learning-by-doing that benefit labour productivity growth (Benkard, 2000).

Chart 14: Employment in tradable industries as a share of total employment in each skill level



Note: tradable industries presented in footnote 2 above.

Finally, the ageing of the Portuguese population, where a quarter of the workforce is expected to be more than 55 years old very soon and is usually less flexible to innovate, is another reason for a slowdown in productivity growth. Aiyar et al (2016) find Portugal as one of the worse affected countries in terms of future MFP growth. This result should be seen cautiously because it is assumed that human capital at that age will not improve. However, the percentage of Portuguese youth (20-24 years old) with a degree is now similar to the EU15 average and, even if it will take some time, the Portuguese Younger Portuguese workers will be more productive when growing older.

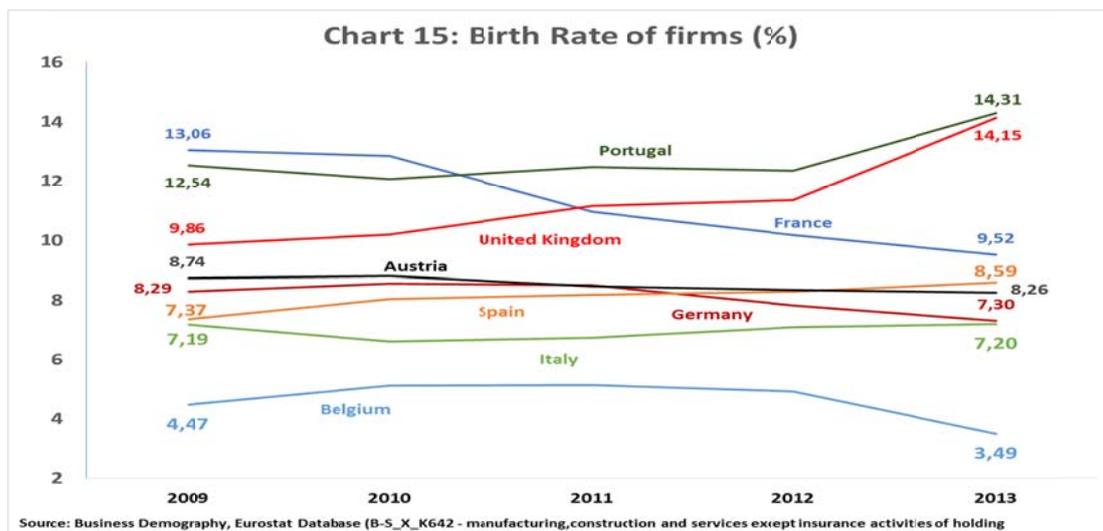
A remarkable progress in formal education in the last 15 years is associated with wasted resources, non-aligned incentives and increasing labour and skills misallocation to low-productivity growth sectors due to double labour market segmentation. These must be improved so that productivity growth can accelerate, even with an ageing population.

3.4 - Business dynamism

Several policy incentives for new firms to be born, grow and thrive were in place for many years: venture capital, business angels, seed financing or an entrepreneurial ecosystem. It was complemented by a friendly business environment where new laws were implemented in a way intended not to be harmful for economic activity. Important legal simplifications and cost reductions for the opening of new firms were implemented in the last 10 years thus reducing barriers to entry.

Portugal was one of the countries with the highest evolution in OECD's Product Market Reforms indicator between 2008 and 2013 (updated every 5 years). It is now 9th among the EU countries and 12th in 33 OECD countries. In a similar way, Portugal has the 25th more favourable business environment among 189 economies (Doing Business 2017, World Bank)

Moreover, the country has a high birth rate of firms (number of new firms in percentage of the existing ones). In 2013, during a severe crisis, it was 14.3%, the fourth higher in 26 European countries (Figure 15). Similarly to what happens in other countries, there is a going-on fad where young entrepreneurs open new internet based firms and show-off at the Lisbon Web Summit.



The above may indicate that the Schumpeterean process of creative destruction is in place. However, its effects are not being felt in terms of productivity growth in Portugal because two main problems are affecting business dynamism.

The first is that new Portuguese firms have also a high mortality rate. Figure 16 shows a decreasing number of firms since 2008 despite the high birth rate. This is not a problem if new firms, with a higher productivity level, are replacing old and stagnant ones. However, most of these start-ups are not able to grow. Between 2009 and 2013 only 6% of the Portuguese firms were less than 2 years old (OECD, 2017b), thus requiring an evaluation of policy incentives.

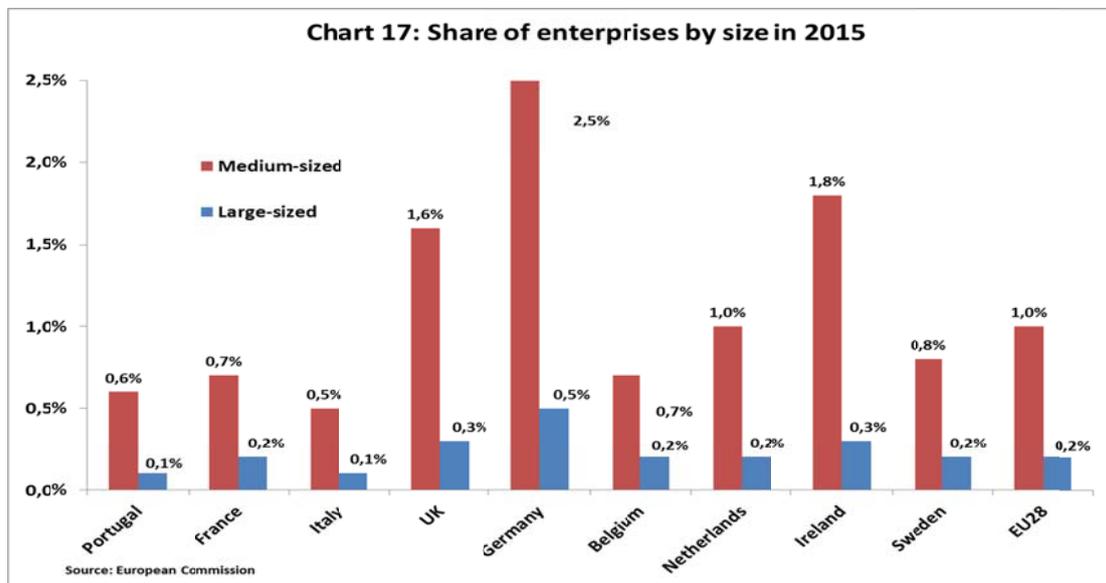
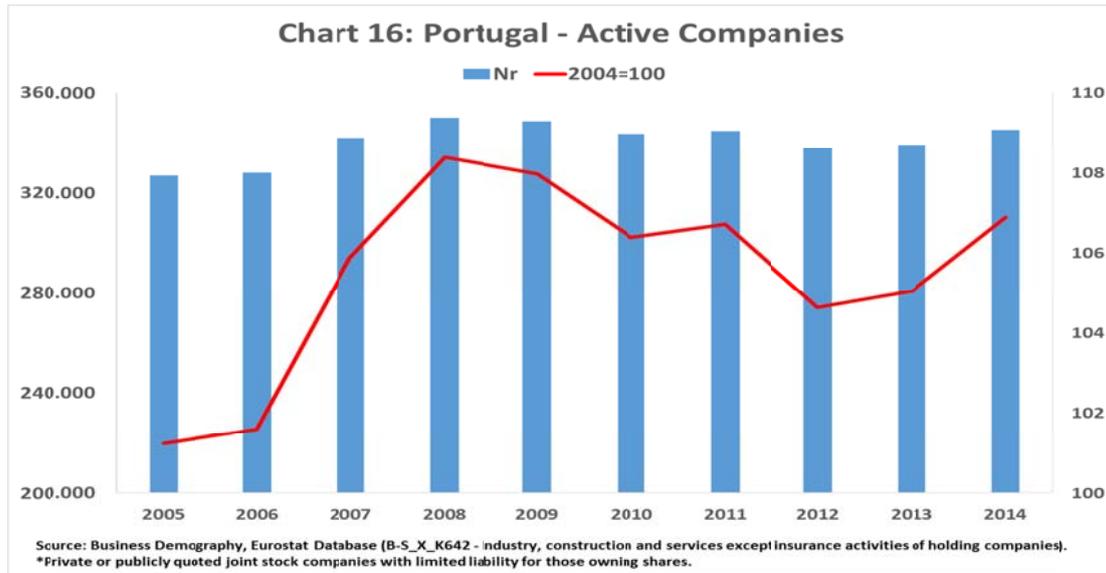
Moreover, half of the small firms are more than 10 years old (OECD, 2017b) but some continue to exist despite being in a near insolvent situation. In the period 2010-2014, 41% of Portuguese firms had to pay in interest more than the cash-flows they could generate in at least one fiscal year. Around 20% of the total paid more in interest than the generated cash-flow in every one of those 5 years. Their survival, even considering tax evasion, indicates that barriers to exit are more present than the high mortality rate might imply and confirm a within-industry resource misallocation (Dias et al, 2015).

Braguinsky et al (2013) also show that Portuguese firms, contrary to firms in other developed countries, are even shrinking and that several labour laws discriminate against medium and large firms, a disincentive to grow. This explains why there are too few firms with more than 50 employees in Portugal, half (in percentage of the total) of the EU28 average, one third of the UK and Ireland or one fifth of Germany (figure 17).

EC data confirms that large and medium-sized Portuguese firms also represent a lower share of employment (37%) than in France (52%), UK, (63%) or Germany (58%), indicating also an inefficient labour allocation. Therefore, creative destruction is not occurring and a misallocation of resources exists because they are not moving from firms with lower productivity growth into new and innovative ones (Lentz and Mortensen, 2008; OECD, 2015a).

The second is that several other obstacles are still affecting the growth of firms. Despite the simplification efforts of the last decade, firms still complain about excessive regulations, a justice system characterized by long delays, an arduous environmental licensing regime and an unstable legal environment, where tax conditions are permanently changing and new levies being introduced (Portugal Statistics, 2015).

Furthermore, too low level of equity capital, not comprehensible and unstable financial policies where alternative financing has a limited impact on firms and a stricter environment that reduces the access to financing, and more so to new firms, are also a barrier. The level of debt of Portuguese firms reached almost 180% of Portuguese GDP in 2012 and, after a considerable deleveraging, it still was at 150% of GDP in mid-2016, one of the highest and 20 p.p. above the Euro area average. Most Portuguese firms face liquidity problems and financing difficulties and, according to Banco de Portugal, almost 30% have non-performing loans.



Finally, the difficulty of new firms to survive increases the market power of incumbents thus reducing product market competition. A consequence is that firms, when facing less competition, have a lower incentive to bear the temporary but “disruptive” costs of introducing productivity-enhancing new technology or changes in production practices (Foster et al, 2001, 2006; Bloom et al, 2015). This is more relevant for non-tradable industries, protected from external competition. Furthermore, it may limit the efficiency of knowledge and technology diffusion mechanisms, thus explaining why there was stability in the dispersion of productivity growth rates since 2005 (section 2.3)

Higher productivity growth requires a business environment where firms survive and may scale-up their activity so that product market competition is increased, resource misallocation is minimized and incentives for firms to invest in enhancing-productivity technology and production practices are activated.

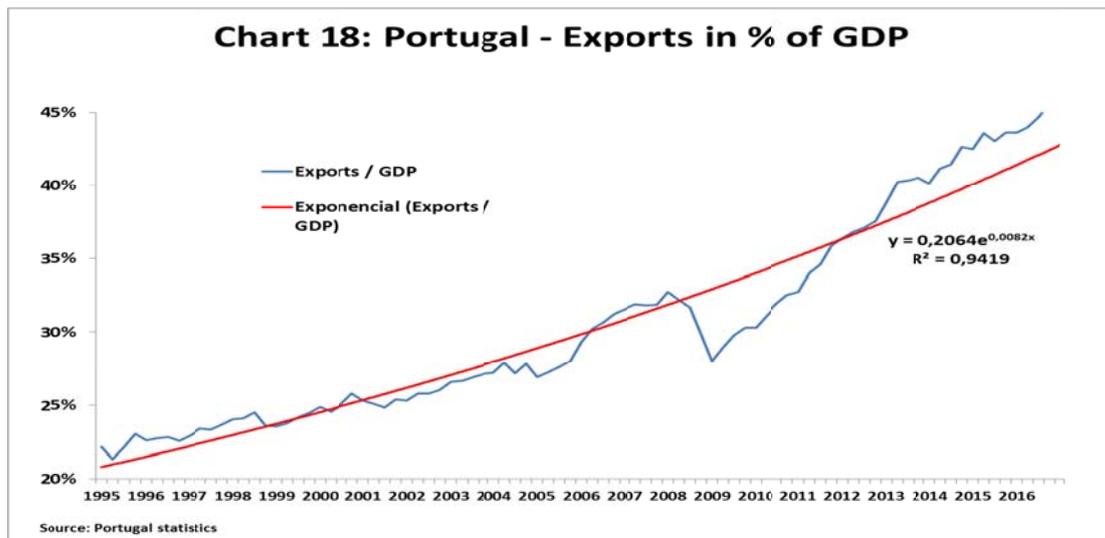
3.5 – Openness and internationalization

Since Adam Smith saw the division of labour as a positive influence to economic growth and, after him, the international trade literature showed the benefits from a better allocation of resources across economies, it is widely believed that more open countries experience faster productivity growth (e.g. Edwards, 1998, for empirical evidence).

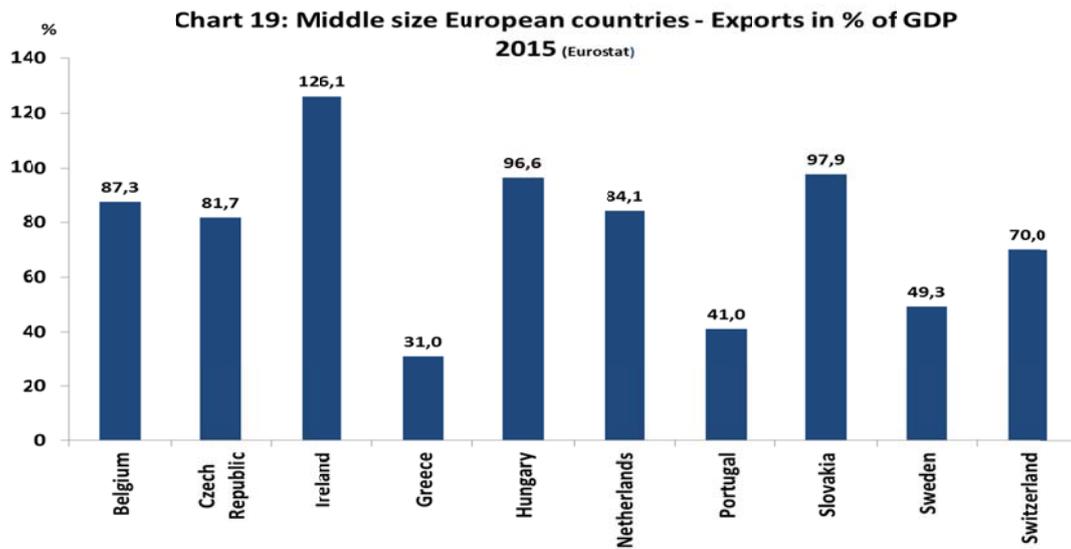
Portugal is a small and a not so open economy, at least if it is compared with countries with a similar size and level of development. Export flows confirm it. Between 1995 and 2008, when resources were mostly allocated to non-tradable sectors, export flows increased moderately but from a low base, from 22% to 32% of GDP.

Despite exponential export growth in the last six years, when Portuguese firms faced a domestic recession and had no alternative than to focus on external markets, the ratio of exports over GDP improved from 29% in 2009 to 40% in 2015, but it still is well below those of other middle sized European countries such as Belgium, Czech Republic, Hungary, Slovakia or Ireland (figures 18 and 19).

After 2010 a growing number of Portuguese firms benefited from a reduction in unit labour costs, gaining market share, looking for new markets and increasing the internationalization of their activities. The total number of exporting firms grew a yearly average of 6% up to 2014, when 1 in 5 Portuguese companies exported goods or services.

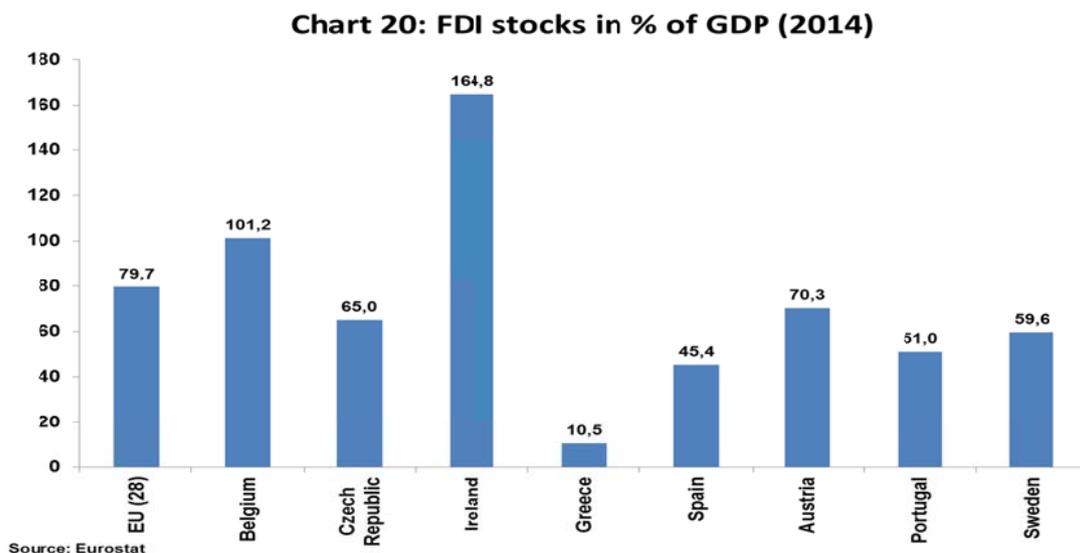


Although economic literature usually finds that more productive firms are the ones that start exporting, some research shows firms seeing productivity growth after entering foreign markets (De Loecker, 2007a). Moreover, an increase in competition abroad can also raise the incentive of firms to engage in innovative activities and induce them to make difficult productivity raising investments, such as quality upgrading in plants, leveraging the benefits of productivity gains across larger markets and leading to aggregate productivity growth via the “within” firm component (Syverson, 2011).

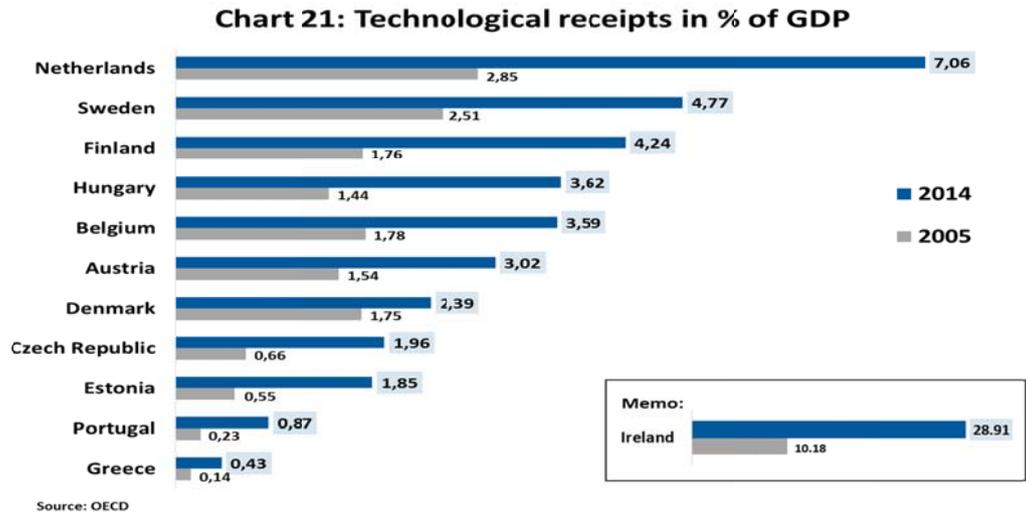


These numbers show that the Portuguese economy is improving its external competitiveness but from a low base. Portuguese firms are slowly adapting to a context where developing countries have almost free access to the EU market. Given that Portuguese exporters are more productive, pay better wages, invest more on human capital and originate larger spillover effects (Correia and Gouveia, 2016), a higher growth in exports would help to reallocate resources to these sectors and minimize the inefficient allocation to non-tradable industries.

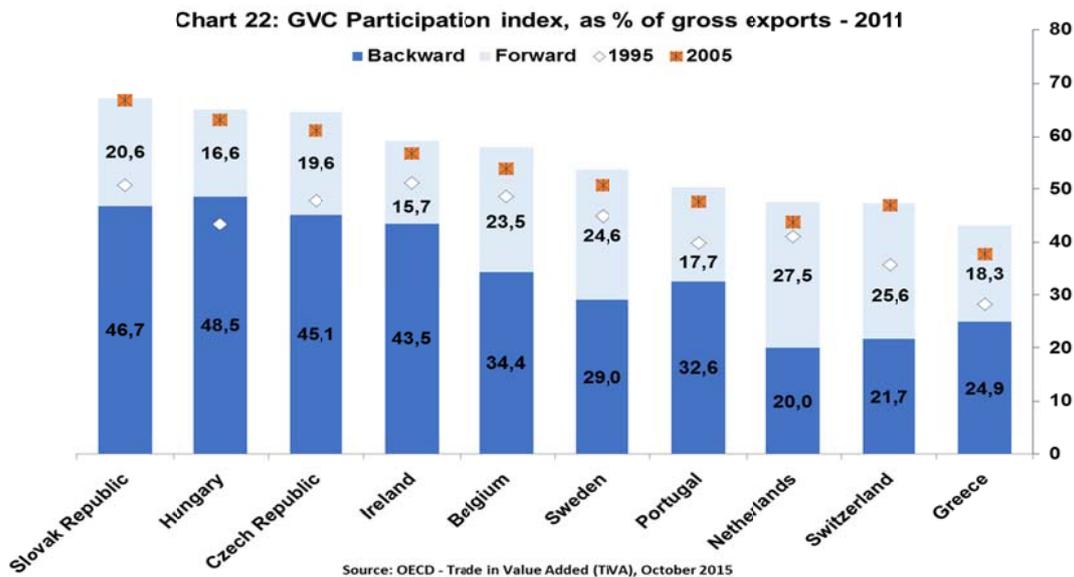
The same idea of a not so open economy is confirmed by the relatively low level of FDI stocks in Portugal (figure 20). Part of it may be associated with its peripheral location in the EU single market and the comparative disadvantage in a mix of production costs, skilled labour and productivity relative to Eastern European countries. The EU entry by these countries in 2004 negatively affected the Portuguese economy by deviating FDI flows from firms in countries such as Germany or Italy. These investments are usually export-oriented and thus allocate resources in tradable sectors. Moreover, FDI driven spillovers may account for a substantial portion of productivity growth, especially in high-tech sectors (Keller and Yeaple, 2009).



A low degree of openness is also seen in Portuguese receipts from the sale and use of patents, non-patented knowledge, drawings and models, brands and technical consulting services. A rapid growth of almost 4 times from 2005 to 2014 (to 0.87% of GDP) led to a positive balance of payments since 2012 but receipts are much lower than in other countries (figure 21). Given that tradable sectors such as ICT, electronics, machinery or pharmaceuticals are the largest investors in R%D, higher and growing receipts may be associated with a better allocation of capital and labour.



The participation in global value chains also confirms that Portugal is not so open as usually is thought (figure 22). The GVC participation index adds up backward, the import content of exports, and forward linkages, the domestic content incorporated in the exports of other countries. The progressive fragmentation of international trade is making Portuguese firms more integrated in global value chains and improving the value added of their production, but at a slow pace when compared with eastern European countries. Portugal is below countries of similar size such as Sweden, Ireland, Hungary or the Czech Republic, and more so in forward linkages, thus delaying potential benefits for productivity growth (Crisuolo et al, 2016).



Although the Portuguese economy is becoming more open, the level of openness is still insufficient if compared with similarly developed economies. More openness, and more competitive firms operating in global markets, is a way to improve resource allocation and reverse the sluggish productivity pace in Portugal.

4 – Conclusion

A growing and deeper integration of the Portuguese economy in global markets was expected to lead to a convergence in productivity to the most developed countries. Paradoxically, this is not happening. After 40 years of democracy and economic integration Portugal still has almost a similar gap in LP and it is facing a decreasing and diverging trend in aggregate productivity growth.

The above assessment of the Portuguese situation indicates that there are different reasons for the slowdown in productivity growth and a lack of convergence with developed economies since the mid-1990s. The more conspicuous is increasing resource misallocation at industry and firm levels:

- Between-sector misallocation of capital in non-tradable sectors and via the insufficient market orientation of R&D investments
- Between-sector misallocation of labour and skills in non-tradable, including state, industries
- Within-sector misallocation of capital and labour from the survival of zombie firms
- Between-firms resource misallocation from the insufficient number of firms able to grow and become large
- Within-firms resource misallocation from low competitive pressure to innovate in non-tradable sectors, originated domestically and abroad, and limited diffusion of knowledge and technology

The recent improvement in some of the productivity determinants was not sufficient. Economic policy was too focused on creating employment independently of their sustainability while ignoring reforms to improve resource allocation and productivity growth. Insufficient policy evaluation explains why it is taking so long to correct these market inefficiencies.

Given that the potential return of policy reforms is significant (e.g. Bouis and Duval, 2011), improved public policies are needed to change incentives, reduce market inefficiencies and enhance aggregate productivity growth (Albrizio and Nicoletti, 2016).

Some pro-productivity policies were or are being tried but often there is a loss of continuity in public policies when a new government takes office in Portugal, thus slashing previous efforts. Moreover, policy evaluation is not embedded as a regular practice, thus hurting the ability to continuously learn and improve public policy. Therefore, evaluation from a productivity perspective can lead to better and rightly focused policies.

The option may be to implement an independent productivity council, similar to Australia's or New Zealand's, with an extensive and transparent coverage of policies across the board (Banks, 2015). This advising body would have the aim to evaluate and to identify and underline the benefits of pro-productivity policies, thus being useful in counterbalancing interests opposed to reforms.

Policy reforms may help to enhance resource allocation, to improve competitiveness and to achieve a higher economic return. Therefore, more is needed from the public sector, namely stable and effective policies that are continuously evaluated.

More is also needed from the private sector. Portuguese firms still are too small, too indebted and structurally too dependent of domestic demand. But firms are the key for the Portuguese economy to become better integrated into global value chains so that the global productivity frontier is more frequently reached. It is a higher return from it that will improve living standards and make Portugal to converge.

References

- Adler, G., R. Duval, D. Furceri, S. Kiliç Çelik, K. Koloskova, and M. Poplawski-Ribeiro (2017), “Gone with the Headwinds: Global Productivity”, IMF Staff Discussion Note 17/04.
- Aiyar, Shekhar, Christian Ebeke and Xiaobo Shao (2016), “The Impact of Workforce Aging on European Productivity”, IMF Working Paper 238.
- Albrizio, Silvia and Giuseppe Nicoletti (2016), “Boosting productivity: a framework for analysis and a checklist for policy”, presented at the Global Forum on Productivity, Lisbon.
- Andrews, D., C. Criscuolo and P. Gal (2015), “Frontier firms, technology diffusion and public policy: micro evidence from OECD countries”, OECD Productivity Working Paper 2.
- Andrews, Dan, Chiara Criscuolo and Peter Gal (2016), “The Best versus the Rest - The Global Productivity Slowdown, Divergence across Firms and the Role of Public Policy”, OECD Productivity working paper 5.
- Arnold, Jens, Natália Barbosa (2015), "Structural policies and productivity: Evidence from Portuguese firms", OECD Economics Department Working Papers, No. 1259, Paris
- Arnold, Jens, C. Farinha Rodrigues (2015), "Reducing inequality and poverty in Portugal", OECD Economics Department Working Paper No. 1258, Paris
- Balasubramanian, Natarajan, and Jagadeesh Sivadasan (2011), “What Happens When Firms Patent? New Evidence from U.S. Economic Census Data.”, *Review of Economics and Statistics*, 93(1): 126–46.
- Balta and Mohl (2014), “The drivers of total factor productivity in catching-up economies”, in *Quarterly Report on the Euro Area* vol13, issue 1, April
- Banks, Gary (2015), “Institutions to promote pro-productivity policies: logic and lessons”, paper presented at “Global Dialogue on the future of productivity growth: Towards an OECD productivity network”, Mexico City, 6-7 July.
- Bartelsman, Eric J., Jonathan E. Haskel, and Ralf Martin (2008), “Distance to Which Frontier? Evidence on Productivity Convergence from International Firm-Level Data”, Centre for Economic Policy Research Discussion Paper 7032.
- Benkard, C. Lanier (2000), “Learning and Forgetting: The Dynamics of Aircraft Production.” *American Economic Review*, 90(4): 1034–54.
- Berlingieri, Giuseppe, Patrick Blanchaney and Chiara Criscuolo (2017), “The Great Divergence(s)” OECD Science, Technology and Innovation Working Paper forthcoming
- Blanchard, Olivier (2007), “Adjustment within the Euro: The Difficult Case of Portugal.” *Portuguese Economic Journal* 6: 1–21.
- Bloom, Nicholas, Mark Schankerman, and John Van Reenen (2007), “Identifying Technology Spillovers and Product Market Rivalry.” NBER Working Paper 13060.
- Bloom, Nicholas, Christos Genakos, Raffaella Sadun, and John Van Reenen (2012), “Management Practices Across Firms and Countries”, NBER Working Paper 17850, February.
- Bloom, Nicholas, Renata Lemos, Raffaella Sadun, Daniela Scur, and John Van Reenen (2014), “The New Empirical Economics of Management”, NBER Working Paper 20102, May.
- Bloom, Nicholas, Mirko Draca, and John Van Reenen (2015), “Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity.” *Rev Econ Stud* (2016) 83 (1): 87-117.
- Bouis, R. and R. Duval (2011), "Raising Potential Growth After the Crisis: A Quantitative Assessment of the Potential Gains from Various Structural Reforms in the OECD Area and Beyond", OECD Economics Department Working Papers, No. 835, OECD Publishing, Paris.

- Braguinsky, Serguey, Lee G. Branstetter, and André Regateiro (2013), "The Incredible Shrinking Portuguese Firms", NBER Working Paper 17265.
- Correia, A.L., Gouveia, A.F., (2016), "What determines firm-level export capacity? Evidence from Portuguese firms", GEE Papers No. 57, April, <http://www.gee.min-economia.pt/>.
- Criscuolo, Chiara, Jonathan Timmis and Nick Johnstone (2016), "The Relationship Between GVCs and Productivity", Global Forum on Productivity, https://www.oecd.org/global-forum-productivity/events/Draft_Paper_Relationship_Between_GVCs_and_Productivity_Final_v12.pdf
- De Loecker, Jan. (2007), "Do Exports Generate Higher Productivity? Evidence from Slovenia." *Journal of International Economics*, 73(1): 69–98.
- Dias, Daniel, Carlos Marques, and Christine Richmond (2015), "Misallocation and Productivity in the Lead Up to the Eurozone Crisis", *International Finance Discussion Papers* 1146.
- Eckaus, Richard (2008), "Portugal: Then and Now", in *Challenges Ahead for the Portuguese Economy*, Francesco Franco ed., ICS.
- Edwards, Sebastian (1998), "Openness, productivity and growth: what do we really know?," *The Economic Journal*, 108 (March), 383-398.
- Foster, Lucia, John Haltiwanger, and C. J. Krizan (2001), "Aggregate Productivity Growth: Lessons from Microeconomic Evidence." In *New Developments in Productivity Analysis*, ed. Charles Hulten, Edwin Dean, and Michael Harper, 303–63. University of Chicago Press.
- Foster, Lucia, John Haltiwanger, and C. J. Krizan (2006), "Market Selection, Reallocation, and Restructuring in the U.S. Retail Trade Sector in the 1990s." *Review of Economics and Statistics*, 88(4): 748–58.
- Fox, Jeremy T., and Valérie Smeets. (2011), "Does Input Quality Drive Measured Differences in Firm Productivity?," National Bureau of Economic Research Working Paper 16853.
- Freitas, Miguel L. (2012), "O Capital", chapter 3 in *História Económica de Portugal 1700-2000*, volume III, Orgs. Pedro Lains and Álvaro Ferreira da Silva.
- Gersbach, Hans, and Armin Schmutzler (2003), "Endogenous Technological Spillovers: Causes and Consequences.," *Journal of Economics and Management Strategy*, 12(2): 179–205.
- Gopinath, Gita, S. Kalemli-Ozcan, L. Karabarbounis and C. Villegas-Sanchez (2017), "Capital Allocation and Productivity in South Europe", *Quarterly Journal of Economics*, (Forthcoming).
- Heitor, Manuel, Hugo Horta and Joana Mendonça (2014), "Developing human capital and research capacity: science policies promoting brain gain", *Technological Forecasting and Social Change*, 78 (8): 1299-1309.
- IMF (2015) "Portugal selected issues", May, IMF Country Report No. 15/127
- IMF (2016), "Fiscal Policies for Innovation and Growth", *Fiscal Monitor* Chapter 2, April
- Isaksson, Anders (2007), "Determinants of total factor productivity: a literature review, Staff Working Paper 02/2007, UNIDO
- Jorgenson, Dale W., Mun S. Ho, and Kevin J. Stiroh. (2008), "A Retrospective Look at the U.S. Productivity Growth Resurgence." *Journal of Economic Perspectives*, 22(1): 3–24.
- Julio, P., R. Pinheiro-Alves and J. Tavares (2013), "Foreign Direct Investment and Institutional Reform: Evidence and an Application to Portugal", *Portuguese Economic Journal* 12, 215-250.
- Keller, Wolfgang, and Stephen R. Yeaple. (2009), "Multinational Enterprises, International Trade, and Productivity Growth: Firm Level Evidence from the United States." *Review of Economics and Statistics*, 91(4): 821–31.
- Lains, P. (2008), "The Portuguese Economy in the Irish Mirror, 1960-2004", *Open Economies Review*, Vol. 19, 667-683

- Lentz, Rasmus, and Dale T. Mortensen. (2008), "An Empirical Model of Growth through Product Innovation.", *Econometrica*, 76(6): 1317–73.
- Gonçalves, Daniel and Ana Martins (2016), "The determinants of TFP growth in the Portuguese manufacturing sector", GEE Papers 62, <http://www.gee.min-economia.pt/>
- McGowan, Müge Adalet, Dan Andrews and Valentine Millot (2017), "The walking dead? Zombie firms and productivity performance in OECD countries", OECD Economics Department Working Papers No. 1372
- McKinsey Global Institute (2004), "Portugal 2010. Increasing productivity growth in Portugal".
- Mercer (2013), "Análise comparativa das remunerações praticadas no sector público e no sector privado", February
- OECD (2015a), "The Future of Productivity", OECD Publishing, Paris.
- OECD (2015b), "OECD Skills Strategy – Diagnostic Report Portugal", Paris.
- OECD (2016), "The Productivity-Equality Nexus: A Concept Paper", OECD Publishing, Paris.
- OECD (2017a), "Labour market reforms in Portugal 2011-2015", OECD Publishing, Paris.
- OECD (2017b), "Economic Survey of Portugal", OECD Publishing, Paris.
- Ollivaud, P., Y. Guillemette and D. Turner (2016), "Links between Weak Investment and the Slowdown in OECD Productivity and Potential Output Growth", OECD Economics Department Working Papers 1304.
- Portugal Statistics (2015), "Custos de Contexto - a perspetiva das empresas", October, Lisboa
- Reis, Ricardo (2013), "The Portuguese Slump and Crash and the Euro Crisis", Brookings Papers on Economic Activity, Spring
- Sakellaris, Plutarchos, and Daniel J. Wilson. (2004), "Quantifying Embodied Technological Change.", *Review of Economic Dynamics*, 7(1): 1–26.
- Santos, S, A. Gouveia and I. Gonçalves (2017), "The Short-term impact of structural reforms on productivity growth: beyond direct effects", GEE paper 65, <http://www.gee.min-economia.pt/>.
- Sondermann, David (2012), "Productivity in the Euro Area: any evidence of convergence?", ECB WP series 1,431, April
- Syverson, Chad (2011), "What Determines Productivity?", *Journal of Economic Literature* 49:2, 326–365.