

In the shadow of the financial crisis: dismal structural change and productivity trends in south-western Europe over the last four decades

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Abstract

Southern European countries have been facing severe sovereign debt and fiscal deficits problems, which have prompted strong increases in bond spreads. These recent developments stimulated an important stream of research focusing on the performance of financial markets and on the relationship between fiscal policy and growth. The analysis of the specific trajectories of countries facing financial crises and of the inter-relatedness of economic and financial crises has received, however, much less attention. In this paper, we give financial crisis an economic frame and shed light on the overall dismal performance of south-western Europe countries (Italy, Portugal, and Spain) by stressing the role of structural change. We argue that the patterns of growth in Europe can be better understood if a regional (in this case a “south-western”), rather than a global European standpoint, is adopted. Resorting to shift-share and growth accounting techniques, we demonstrate that from the mid nineties onwards the most important contributor to labour productivity growth of south-western European economies – goods production industries – suffered a drastic decline. In contrast, low productivity services sectors gained momentum. Such transformations are explained in the light of the increased economic integration experienced by the three countries, and are shown to be correlated with countries’ international specialization patterns (against high skill and science-based activities) and education performance. Based on south-western European experience, we conclude that the exclusive focus on policies of fiscal restraint is not sufficient if a long-term growth strategy is envisaged. Any attempt to overcome the present difficulties must necessarily take into account productivity-driven and export-led growth policies which require a longer term, spatial and historical perspective.

Keywords: Long-run growth; structural change; south-western Europe; Italy; Portugal; Spain

JEL-Codes: O47; O14; O57.

1. Introduction

“Is there a specific Latin or south-west European pattern of economic modernization? [Evidence] would suggest that there is.” (Tortella, 1994: 1)

Global financial crisis at the Eurozone, and most notably in its southern states (Greece, Portugal, Italy and Spain), has been dominating the economic and political debates worldwide (Young and Semmler, 2011). The OECD announced that the Eurozone debt crisis was the world's greatest economic threat in 2011,¹ and things have only worsened in 2012. Since late 2009, the global financial and economic crisis, with its roots in the US sub-prime mortgage crisis, has mutated into a sovereign debt crisis centered on the European Union and some of its Member States. The debt default in Greece escalated the potential for sovereign debt defaults from Portugal, Italy, and Spain (Arghyron and Tsoukalas, 2011), while apprehension regarding the capability of European governments in restraining national debt levels has disturbed the confidence of investors in the Eurozone and raised doubts as to the future sustainability of the Euro (Fernandes and Mota, 2011).

In Europe, public discourse has been dominated by deficit discipline, prices stability and austerity measures. Debt crisis forced some countries (e.g., Greece, Portugal, Spain) to introduce austerity measures to get assistance from the European Union and IMF (Mckinsey & Company, 2012). These included cuts in cash benefits, public service and expenditures, along with an increase in taxation in order to restrain budget deficits.

Without denying the need for fiscal and public imbalances' consolidation in some European countries, particularly those from south-western Europe, in the present paper we argue (and demonstrate) that the focus on financial crisis and austerity plans overlooks a more conspicuous problem: the economic backwardness and the erosion in international competitiveness of these countries rooted well back in time and reflected in rather low rates of income and productivity convergence, or even divergence, vis-à-vis more developed countries. If policies aimed at addressing and solving these longer term, structural growth weaknesses are not envisaged, (short term) austerity plans and overemphasis on financial and fiscal solutions are doomed to fail. As referred by the Nobel prize Paul Krugman “[t]he combination of austerity-for-all and a central bank morbidly obsessed with inflation makes it

¹ In <http://www.reuters.com/article/2011/11/28/us-oecd-economy-idUSTRE7AR0FQ20111128>, accessed on 10 June 2012.

essentially impossible for indebted countries to escape from their debt trap and is, therefore, a recipe for widespread debt defaults, bank runs and general financial collapse.”²

In an influential work, Tortella (1994) raised the question “Is there a specific south-west European pattern of economic growth?”. His answer, based on the study of the long-run trajectories of Spain, Portugal and Italy between 1800 and 1980, was affirmative: the comparative performance of all three countries relative to a European norm was notoriously alike, with patterns of convergence, stagnation and divergence being found within virtually the same periods. If we raise the question once again for the more recent period, the answer will probably be the same. In fact, as we show in the following sections, and despite the differences in per capita income and productivity levels among the three countries, there is close proximity with regard to relative trends in these variables from the 1980s onwards. In these circumstances, one should look for possible explanations that could be applicable for the south-western European region as a whole, and that go beyond the three countries’ specificities.³

Along with geographical closeness, which represents to some extent a measure of similarity in terms of cultural and institutional factors, Italy, Spain and Portugal share two traits which can explain the common features of their growth patterns: an economic structure which, although with a different degree across countries, still presents a bias with respect to low-skill and low-tech activities, and a major educational deficit. Bypassed by the short term discussions on deficits and austerity, the inter-related features of educational, technological and economic backwardness and their relation with competitiveness losses stand as the core explanation for southern European countries’ dismal economic performance. As the persistence over time of a large agricultural sector acted as a restraint on south-western economies over the 19th and part of the 20th centuries, along with illiteracy and public mismanagement, a similar role is now played by a number of low-skill, low-productivity growth activities, most notably in the non-tradable sector, which gained importance with the inception of the Economic and Monetary Union, and which explain, to a large extent, the slowdown in productivity growth and the emergence of an economic crisis prior to the emergence of the financial crisis.

² *Killing the Euro*, in The New York Times (<http://www.nytimes.com/2011/12/02/opinion/krugman-killing-the-euro.html>, accessed on 10 June 2012).

³ Although the Greek case is not analyzed in the present paper due to data limitations, notably the absence of estimations of capital services, Antzoulatos’ (2011) complementary account of the 2010 ‘Greek tragedy’ is consistent with our analysis of Italy, Portugal and Spain, reinforcing Tortella’s vision of a ‘a specific southern European pattern of economic growth’.

The paper is organized as follows. The next section provides an overview of the growth performances of Italy, Portugal and Spain during the past three decades, and relates these experiences with the overall trends observed in the EU. It is shown that the three south-western countries experienced a stronger decline in labour productivity growth after 1995, which was mostly due to the deceleration of multifactor productivity growth. Section 3 provides an interpretation for the trends observed based on the role played by structural change, with special focus on the changes recorded with regard to goods-producing and market services industries. It is shown that despite the overall progress found, changes in the economic structure towards more skill- and technology-intensive sectors were relatively slow in the countries under study. Section 4 provides a tentative explanation for the relative persistence of a low-skill, low-tech bias in Italy, Portugal and Spain’s productive structures in the context of increasing economic integration of the three countries, exploring the role played by trade induced changes and by the characteristics of the workforce. The final section presents a brief summary and concludes.

2. Productivity trends in south-western Europe: 1980-2007

Although Italy, Portugal and Spain performed differently among themselves – Italy and, to a lesser extent, Spain’s per capita income and productivity levels were substantially above those of Portugal –, the trends in comparative per capita income for these countries vis-à-vis the EU core followed a general pattern of rather slow convergence since the mid-1980s, and even of divergence in the more recent years.

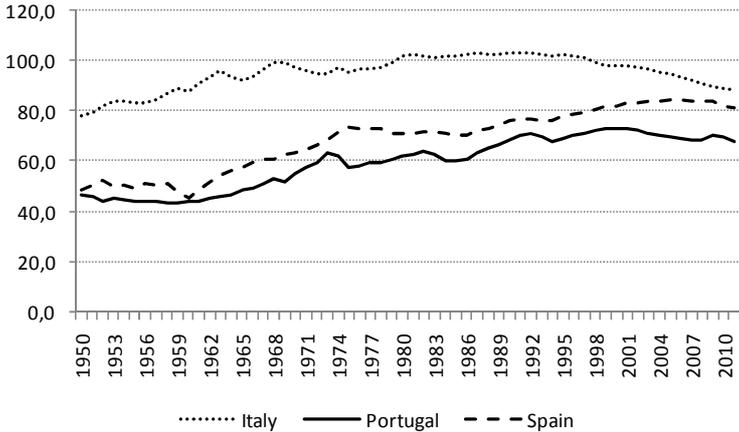


Fig. 1: GDP per capita in 1990 US\$ (converted at Geary Khamis PPPs) comparatively to the EU-15 (Italy, Portugal and Spain, 1950-2011)

Source: The Conference Board Total Economy Database, January 2012

The same picture arises from the inspection of labour productivity growth rates, which have been rather low in the last three decades and show a consistent long-run tendency of decline (cf. Figures 2 and 3).

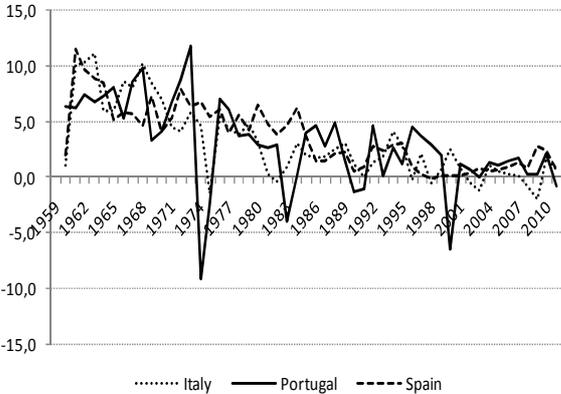


Fig. 2: Labour productivity growth in (GDP per hour) Italy, Portugal and Spain, 1959-2011

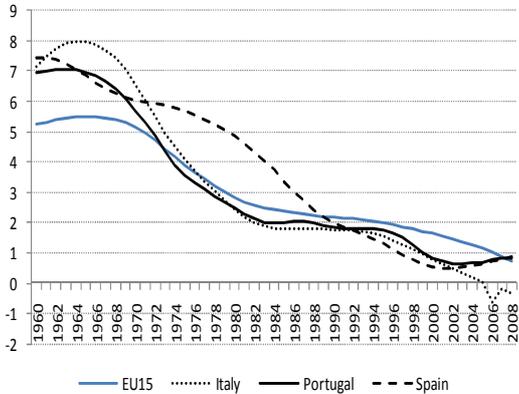


Fig. 3: Labour productivity growth trend, Italy, Portugal, Spain and EU-15, 1959-2011

Note: Trend obtained from annual data using a Hodrick-Prescott filter ($\lambda = 100$)

Source: The Conference Board Total Economy Database, January 2012

Indeed, a common feature of the three countries is the more profound deterioration of growth than the European average previous to the emergence of the financial crisis. Although the average long-term growth of labour productivity in Europe has practically stalled since 2000, the situation has been worse in south-western Europe. The last decade was particularly harsh for Italy, Portugal and Spain: not only have they experienced slower growth, in line with many other European countries, but the gap with the EU core has also increased. This is a matter of deep concern, particularly for the two latter countries: despite remaining at a considerable distance from EU labour productivity and per capita income levels, the large catch-up potential has not been realized, which seems to indicate that these country’s strategies of growth have been failing.

A preliminary assessment of the factors explaining growth performances in Southern Europe in the last 30 years can be conducted based on the neoclassical growth accounting framework developed by Jorgenson and associates (Jorgenson and Griliches, 1967; Jorgenson, Gollop

and Fraumeni, 1987, Jorgenson, 1995), under which output growth is divided into the contributions of inputs and productivity growth.⁴

The growth breakdowns regarding Italy, Spain and the EU-10 are based on data from the November 2009 release of the EU-KLEMS database, updated in 2011.⁵ Because this database does not provide information on the capital input for Portugal, we update Silva's (2010) capital services' series in order to perform the growth accounting exercise for the Portuguese case.⁶ Data on output growth and hours worked in Portugal are also from the EU-KLEMS database.

Table 1: Contributions to real output growth and labour productivity growth, Spain, Portugal and EU-10, 1980-2007 (annual average growth rates in percentage points)

	Italy			Portugal ¹			Spain			EU-10		
	1980-95	1995-07	1980-07	1980-95	1995-06	1980-06	1980-95	1995-07	1980-07	1980-95	1995-07	1980-07
Output	2.0	1.4	1.8	2.7	2.4	2.5	2.5	3.5	2.9	2.2	2.2	2.2
Hours worked	0.1	0.9	0.5	-1.5	0.7	-0.6	0.0	2.8	1.3	-0.2	0.8	0.3
Labour productivity	1.9	0.6	1.2	4.1	1.7	3.0	2.5	0.7	1.6	2.3	1.4	1.9
<i>Contributions from:</i>												
Labour composition	0.3	0.1	0.2	-	-(0.3)	-	0.6	0.4	0.5	0.3	0.1	0.3
Capital deepening	0.8	0.6	0.7	1.9	1.1	1.6	1.4	0.9	1.2	1.1	0.9	1.0
TFP	0.8	-0.1	0.3	2.2	0.5 (0.2)	1.4	0.5	-0.6	0.0	0.9	0.4	0.6

Note: 1) Numbers in parentheses use data on labour composition growth from The Conference Board Total Economy Database, January 2012.

Sources: EU-KLEMS Database and author's calculations for Spain and EU-10; EU-KLEMS Database, INE and author's calculations for Portugal. Numbers may not sum up exactly due to rounding.

Table 1 shows that the main factors explaining the overall disappointing performance of the three countries are not to be found in differences in the intensity of production factors, although Italy's rates on capital accumulation have been lower than the EU average. In fact, in all cases the main factor explaining the slowdown in labour productivity and the higher difficulties in catching up resides in the contribution of multifactor productivity growth. Portugal, Italy and Spain experienced a more intense decline in multifactor productivity growth than the EU since 1995, which has even become negative in the two latter countries.

⁴ The comparison with the EU is now restricted to the countries for which EU-KLEMS provides information on capital input and multifactor productivity growth rates. More precisely, the EU-10 acronym includes Austria, Belgium, Denmark, Finland, France, Germany, Italy, the Netherlands, Spain and the United Kingdom.

⁵ Available online at <http://www.euklems.net>.

⁶ In relation to Silva's (2010) original estimates, the new capital input series differ in a number of methodological aspects, which were implemented in order to get more precise estimates and achieve greater comparability with EU-KLEMS estimates. The methodology used in the estimation of the capital input series is described in the Appendix. Volume indices of capital services at the industry and macroeconomic levels are presented in Table A.1.

As a matter of fact, the three south-western economies stand among the European countries with worst TFP performance in the last decade, and also in the more recent years.⁷

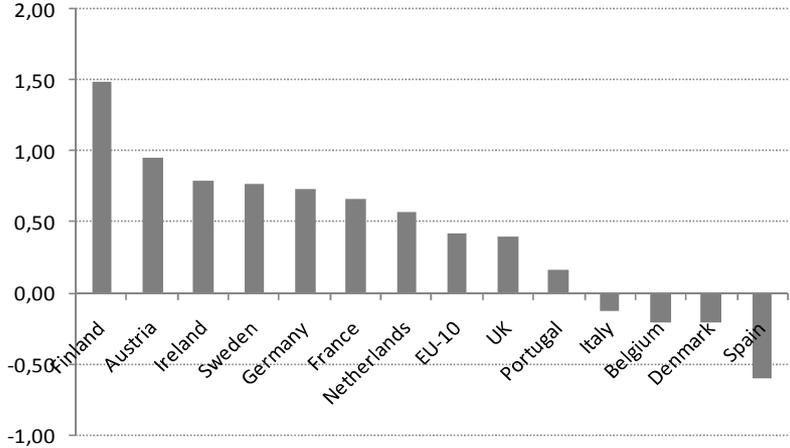


Fig. 4: Multifactor productivity growth (annual average growth rates in percent, 1995-2007)
 Note: Reference period for Portugal is 1995-2006
 Sources: cf. Table 2

In order to explain the disappointing performance of the three Latin economies, attention must be paid therefore to the potential causes explaining the trends in multifactor productivity decline. Multifactor productivity is generally related to the overall efficiency of the production process and may be influenced by several factors, including the effects derived from pure technological change and innovation, changes in returns to scale, and organizational and managerial improvements. The sectoral composition of the economy may have an important impact on these factors. Sectors differ in their productivity potential, depending on the scope for innovation and technological progress, and therefore specializing in high-tech sectors may generate an important productivity bonus. The shift of resources from low-productivity to high-productivity sectors may in itself represent a significant source of long-run productivity growth. High-tech and high-skill sectors may also have a positive impact on aggregate productivity growth by generating positive spillovers to the other branches of the economy. The links between structure and productivity growth are explored in the following section.

3. Explaining the decrease in productivity growth: the role of structural change

3.1. General trends

To better understand the influence of structure on productivity growth, we need to move from the macroeconomic to the industry level of analysis, by examining the role played by the

⁷ Preliminary estimates of TFP growth determined in The Conference Board Total Economy Database, January 2012 show that Portugal, Spain and Italy are also the Western Europe countries which show worst performance in TFP growth during 2008-2011, along with Greece.

different industry groups on the aggregate economy. Considering the breakdown of economic activity used in van Ark et al. (2008), Table 2 presents the contributions of four major sectors to overall labour productivity growth (information and communication technology production, goods production, market services, and a group composed of non-market services and real estate activities).⁸ Along with data for Portugal, Spain and the EU-10, Table 2 provides information regarding the US, which is usually taken as a benchmark in the studies focusing on the European productivity slowdown after 1995 (e.g., van Ark et al, 2008; Inklaar et al, 2008, Maudos et al, 2008).

Table 2: Major sector contribution to average annual **labour productivity growth** in total economy, 1980-2007 (annual average growth rates, in percentage points)

	Total economy	ICT Production	Goods production	Market services	Non-market serv. & RE	Reallocation
Italy						
1980-1995	1.9	0.2	1.4	0.0	0.3	0.1
1995-2007	0.7	0.2	0.2	0.0	0.2	-0.2
1980-2007	1.3	0.2	0.9	0.0	0.3	-0.1
Portugal						
1980-1995	4.1	0.3	1.7	1.1	0.3	0.7
1995-2006	1.7	0.4	0.6	0.5	0.1	0.1
1980-2006	3.0	0.4	1.2	0.8	0.2	0.4
Spain						
1980-1995	2.5	0.2	1.8	0.4	0.1	0.1
1995-2007	0.7	0.2	0.1	0.4	0.1	-0.1
1980-2007	1.6	0.2	1.0	0.3	0.1	0.0
EU-10						
1980-1995	2.3	0.2	1.2	0.4	0.4	0.1
1995-2007	1.4	0.4	0.5	0.4	0.2	-0.1
1980-2007	1.9	0.4	1.0	0.4	0.3	-0.1
US						
1980-1995	1.2	0.3	0.5	0.5	-0.1	-0.1
1995-2007	2.4	1.2	0.3	1.1	0.1	-0.4
1980-2007	1.7	0.9	0.5	0.7	0.0	-0.4

Source: Author's calculations based on the EU-KLEMS Database, November 2009 release. Data regarding the US are taken from the revised version of this database, released in June 2010. Numbers may not sum up exactly due to rounding.

Table 2 shows that the main factor explaining the slowdown in labour productivity growth in Italy, Portugal, Spain and the EU-10 is found in a strong decline in the contribution of the goods production industry group. This decline has not been compensated by an increase in the contributions from other industry groups, notably market services and ICT-producing sectors,

⁸ The ICT production sector includes the production of electrical machinery and telecommunication services; the goods production sector includes agriculture, mining, manufacturing (except electrical machinery), utilities and construction; the market services sector includes trade, hotels and restaurants, transport services, financial and business services, and social and personal services; and finally, non-market services include health and education services, along with public administration and defence.

which have recently been the major sources of growth in faster growing economies (cf. van Ark et al, 2008; Jorgenson et al., 2005).

The decline in the contribution of the goods industry group to overall productivity growth in the more recent period was, to some extent, to be expected. During the period analyzed, Italy, Portugal and Spain experienced a major shift in production and employment from the goods-producing industries towards services, in line with the broader European experience. (cf. Table 3).⁹

Table 3: Employment shares (hours worked) and labour productivity growth (annual average growth rates in percent) in the industry groups, 1980-2007

	Italy		Portugal		Spain		EU-10	
	1980	2007	1980	2006	1980	2007	1980	2007
Employment (%)								
Goods production	49.6	31.3	57.2	40.6	49.7	34.1	43.5	27.0
ICT production	3.8	2.9	2.0	1.5	2.3	2.1	4.4	3.0
Market services	33.1	51.0	30.9	42.2	35.1	45.6	30.4	41.4
Non-market services and real estate	13.6	14.7	9.9	15.7	12.9	18.1	21.7	28.6
Labour productivity growth								
	1980-95	1995-07	1980-95	1995-06	1980-95	1995-07	1980-95	1995-07
Goods production	3.6	0,6	4.2	2.0	4.4	0.3	3.3	1.7
ICT production	4.0	4,5	8.4	8.5	5.2	3.2	5.1	6.8
Market services	0.0	0,0	3.4	1.4	1.1	0.7	1.4	1.2
Non-market services and real estate	1,2	0,8	1.4	0.3	0.3	0.4	1.4	0.6

Source: Author's calculations based on the EU-KLEMS Database, November 2009 release.

This decline was, however, notably higher in Spain and Italy, and to a lesser extent, in Portugal, countries in which the contribution from this group of industries was traditionally very important. Annual average productivity growth in the goods production industry declined by about 90% in Spain and Italy, and 65% in Portugal, whereas in the EU the corresponding rate was of 58%. Moreover, in Portugal the contribution of market services decreased considerably, which is at odds with the recent growth experience of faster growing economies, most notably the US (cf. Table 2), the United Kingdom or the Netherlands (c.f. van Ark et al, 2008; Inklaar et al, 2008). In Spain, the contribution of market services to

⁹ The decline in labour share in the goods-producing industry between 1980 and 2007 can be attributed to the influence of two complementary factors: an absolute decline in the number of hours worked in that sector, and rapid creation of employment in the services sector. It should be noted, though, that whereas in Italy and Portugal there was a sustained decline in employment in the goods-producing industry during the period considered, in the case of Spain, after a period of decline, the number of hours worked in this sector increased consistently from 1994 onwards, being in 2007 only about 2% lower than in 1980. This increase is, however, mostly related to the strong upward experienced in construction activities.

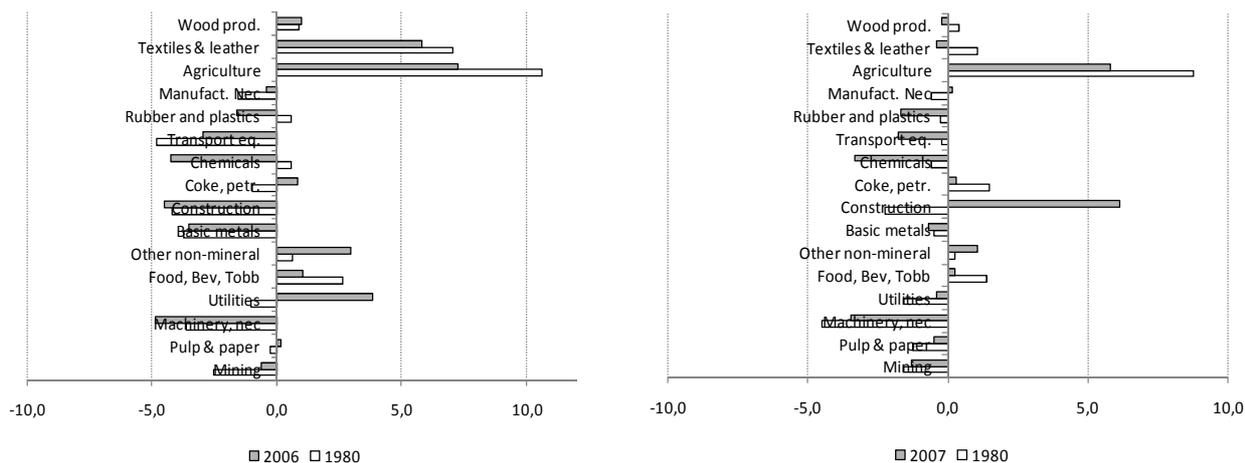
overall labour productivity growth remained unchanged, despite its growing importance in employment, whereas in Italy there is virtually no contribution from this group of industries.

To better grasp the factors underlying the poor performance of the three south-western European countries, a more in-depth study is thus necessary of the strong decline in productivity growth within the goods-producing industry group, and of the causes explaining the relative weakness of these countries in the sectors which have been the major sources of growth in fast-growing economies in the more recent period, i.e., market services and ICT sectors. This analysis is performed in the following sections.

3.2. The goods-producing industry group in Portugal and Spain: the persistence of a strong bias towards low-skill and low-tech activities

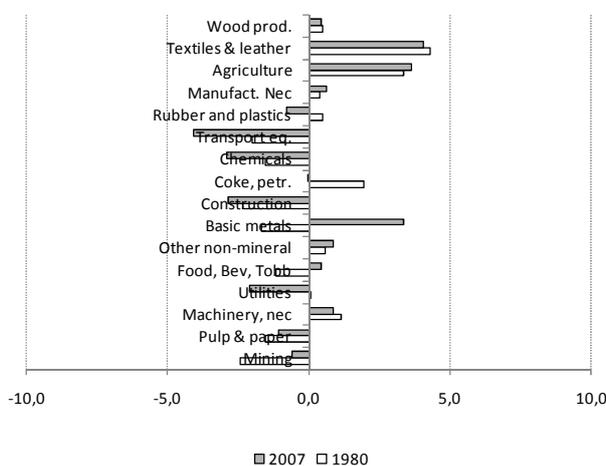
The differences in the production structures of goods-producing industries in Italy, Portugal and Spain relative to the EU-10 (cf. Figure 5) did not decline during the 30-year period analyzed (in the former country they have inclusively increased).

Although some convergence has been reached in agriculture (Portugal and Spain), as well as in other traditional industries such as textiles and food, beverages and tobacco, whose importance decreased consistently over time, an increasing divergence came into play in other sectors. In Portugal, the most notable changes took place in the utilities and other non-metallic mineral products industries, which increased their shares considerably, whereas in Spain, a remarkable increase took place in construction, whose real GVA grew at an annual average rate of 5.7% between 1980 and 2007, and which now accounts for almost 30% of the total value added in goods-producing industries. In Italy, along with an increase in the agriculture differential relative to the EU-10, there was also an impressive rise in basic metals industries' production share. In all countries, the negative gap with respect to chemicals increased markedly, whereas other high-skill and high-tech activities such as transport equipment and machinery and equipment remained under-represented (cases of Portugal and Spain) or reduced their positive differential (case of Italy, with respect to the latter industry).



Portugal – EU-10
Krugman index: 1980: 0.46; 2006: 0.46

Spain – EU-10
Krugman index: 1980: 0.27; 2006: 0.27



Italy – EU-10
Krugman index: 1980: 0.25; 2007: 0.29

Fig. 5: Gross value added shares in goods-producing industries in Italy, Portugal and Spain (differences relative to the EU-10, GVA at constant 1995 prices)

Note: The Krugman index is defined as $K_j(t) = \sum_i |S_j^i(t) - \bar{S}^i(t)|$, where $S_j^i(t)$ is the share of sector i in country j at time t based on gross value added at constant 1995 prices, and $\bar{S}^i(t)$ is the share of sector i in the EU-10.

Source: EU-KLEMS Database, Nov. 2009.

The comparison of productive structures in goods-producing industries and of their changes over time indicates therefore that a strong bias in low-skill and low-tech activities is still characteristic of Italy, Portugal and Spain's productive specializations. This point is further explored in Table 4, which provides a comparison of the technology and skill contents of the

goods-producing industries in the three countries relative to the EU, based on Peneder (2007) and Tidd et al.'s (2005) classification schemes.¹⁰

Table 4: Goods-producing industry shares in GVA and labour productivity (annual av. growth rates, in percentage points) in industry groups

		Italy		Portugal		Spain		EU-10	
Skill taxonomy		1980	2007	1980	2006	1980	2007	1980	2007
Industry shares (%)	Very Low	22.0	19.3	32.4	25.1	24.1	16.3	13.8	11.1
	Low	40.5	43.5	40.4	37.6	44.0	48.4	45.1	41.6
	Medium-low	6.2	6.4	4.4	4.6	4.5	5.0	5.4	6.6
	Intermediate	20.6	21.5	15.9	22.8	14.5	18.8	23.4	24.4
	Medium-high	10.7	9.3	7.0	9.9	12.9	11.5	12.3	16.3
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		1980-1995	1995-2007	1980-1995	1995-2006	1980-1995	1995-2007	1980-1995	1995-2007
Labour Productivity	Very Low	5.6	1.4	5.0	0.7	5.8	2.1	4.7	2.3
	Low	1.9	-0.1	2.9	0.3	2.7	-1.4	1.8	0.5
	Medium-low	1.0	0.8	3.6	1.1	3.5	1.2	2.6	2.6
	Intermediate	2.5	0.4	4.4	4.1	4.2	1.8	3.5	2.2
	Medium-high	4.6	-0.2	3.5	7.1	4.1	0.9	4.9	3.0
Innovation taxonomy		1980	2007	1980	2006	1980	2007	1980	2007
Industry shares (%)	Sup-dominated	50.5	46.2	58.4	50.6	52.0	52.3	45.8	41.3
	Scale-intensive	34.8	36.7	29.5	40.3	38.8	36.2	39.5	38.8
	Spec. supplier	11.5	11.9	6.8	5.4	5.1	6.7	9.9	11.9
	Science-based	3.3	5.1	5.3	3.7	4.2	4.7	4.8	8.0
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		1980-1995	1995-2007	1980-1995	1995-2006	1980-1995	1995-2007	1980-1995	1995-2007
Labour Productivity	Sup-dominated	3.7	0.6	4.7	0.4	4.6	0.1	3.1	1.2
	Scale-intensive	2.9	0.4	3.9	4.1	3.6	1.0	3.2	1.9
	Spec. supplier	1.8	0.2	0.2	3.2	4.2	0.9	3.2	2.5
	Science-based	7.6	0.8	3.3	2.8	5.7	0.6	6.1	3.6

Source: EU-KLEMS Database, Nov. 2009. Note: Peneder's taxonomy classifies industry 34 as intermediate and industry 35 as medium-high skill. In the aggregation of the two industries we considered the medium-high skill classification.

¹⁰ Peneder's (2007) taxonomy classifies industries according to their educational workforce composition, distinguishing among seven categories, from very high to very low educational requirements. It combines educational attainment data, compiled in a collective effort coordinated by the National Institute of Economic and Social Research (NIESR), with industry data gathered from the OECD STAN database. The innovation taxonomy developed by Tidd et al. (2005) constitutes a refinement of Pavitt's original classification scheme (Pavitt, 1984), which includes the information-intensive category along with the former Pavitt categories: supplier-dominated, scale-intensive, science-based and specialized suppliers. These four categories establish a gradual scale of technological opportunities, identified with the number of significant innovations achieved: they are lowest in supplier-dominated firms, in which most of the technological advances come from suppliers of equipment and other inputs; they are relatively higher in scale-intensive firms, which develop investment and production activities in large-scale production systems and major sources of innovation come from production engineering departments and suppliers of specialized inputs; and finally, they are highest in science-based and in specialized supplier firms, the former characterized by high levels of in-house R&D and strong links with science, and the latter facing continuous pressures to improve efficiency on the part of their users. Table A.2 in the Appendix presents the classification of industries according to the selected taxonomies.

Table 4 shows that the division of the goods-producing industry group according to the selected taxonomies did not change much in the south-western European countries during the whole period under study. With regard to the skills classification, the most important change took place within the broad low-skill group, with low-skill activities increasing their relevance in detriment of very low-skill ones. The aggregate of very low- and low-skill industries remained, however, practically unchanged, as did the skill gap relative to the EU. Medium-low and intermediate skill industry shares increased by a small amount, whereas medium-high industry shares registered a slight decline.¹¹

The analysis of the composition of the goods-producing industry group according to the innovation taxonomy reveals furthermore that the greater reliance of the three countries on supplier-dominated industries, the industry group with fewer technological opportunities, remained virtually intact. Science-based and specialized-supplier industries, on the other hand, which are the top categories under Tidd et al.'s innovativeness scale, increased their (negative) distance relative to the EU in all three countries, while remaining of little importance in Portugal and Spain.

Looking at the average rates of labour productivity growth of the goods-producing industries classified according to the aforementioned taxonomies, it is clear that the decline in productivity growth was more intense precisely in the more representative industry groups of the three countries' economic structures. This partially explains their poorer performance since 1995.

Until 1995, low-skill activities, which are essentially characterized as supplier-dominated under Tidd et al. (2005) taxonomy,¹² benefited from intense productivity growth, particularly in south-western Europe. In these industries, increases in productivity stem mostly from the adoption of technology developed by supplier firms through the acquisition of equipment and inputs (Pavitt, 1984; Tidd et al, 2005). The evidence displayed in Table 4 seems to indicate that this source of productivity growth became less important in more recent years. This is broadly in line with some views expressed in the literature, which suggest that after the ICT "revolution" of the 1980s and 1990s, it became more difficult to converge on the basis of mere imitation or diffusion, whereas innovation directly pursued by firms has increased its relative importance (e.g., Fagerberg and Verspagen, 2002, 2007). This seems to comprise a matter of deep concern in countries such as those under analysis, where industries more prone

¹¹ Except in Portugal, country in which there was an increase in these industries' share.

¹² See Table A.2 in the Appendix.

to innovate have still relatively modest shares in total production and employment, and domestic innovation levels, proxied by patent counts, are rather low (c.f. Pilat, 2005; Pilat et al, 2006; Teixeira and Fortuna, 2010).

Furthermore, the low importance of technology advanced industries has probably influenced the three countries negatively, by reducing the extent to which they could benefit from positive spillovers arising in these industries.¹³ This explains, to some extent, the stronger decline in productivity growth in the industry groups considered, including in some cases high-skill and high-tech industries.

3.3. Market services and ICT production: weak sources of productivity growth

In contrast with other countries that have recently experienced fast labour productivity growth (e.g., the United States, Finland, the United Kingdom), in which growth has been mainly driven by market services and information and communication technology-producing sectors (cf. van Ark et al, 2008), in south-western Europe these sectors have remained relatively weak sources of aggregate productivity growth.

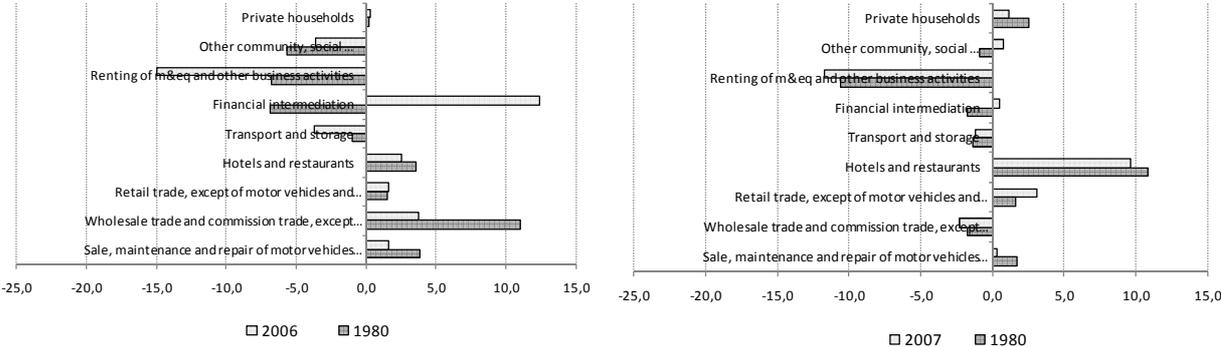
The ICT-producing industries group is relatively small, and for that reason its contribution to aggregate productivity growth is of little importance, despite its high rates of labour productivity, particularly in Portugal (cf. Table 3).

Market services, on the other hand, have become progressively more important over time, accounting in 2007 for a higher share of total employment in south-western countries than the European average (cf. Table 3). In this case, the small contribution to aggregate productivity growth after 1995 is essentially the result of slow productivity growth, since most of the growth in these activities has taken place in low-skill, low-productivity growth services. This becomes evident from the inspection of Figure 6, which provides a comparison of Italy, Portugal and Spain's structures in market services with the EU-10, based on the industry shares in real value added.

From Figure 6 it is apparent the persistence or even a widening, in the Portuguese case, of the differences in the three countries' structures relative to the EU during the 1980-2007 period, reflected by the evolution of the Krugman index. Distribution services remain more important in Portugal and Italy, despite the convergence that had already taken place. Due to the importance of tourism activities in the three countries, positive differences subsist with

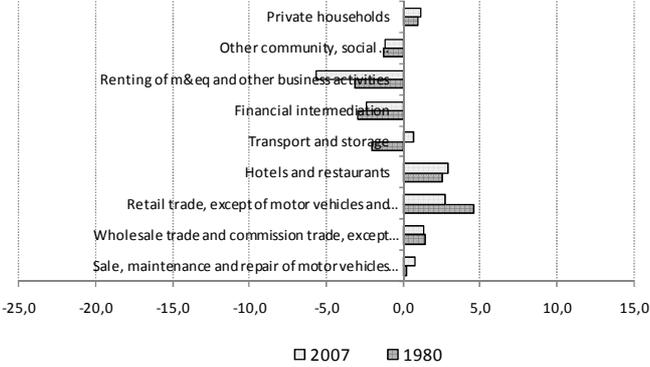
¹³ Several studies show evidence of beneficial spillover effects from the technologically advanced industries to the rest of the economy during the period under analysis. See, for example, O'Mahony and Vecchi (2009).

respect to hotel and restaurant services, particularly in the case of Spain, in which they individually account for about 15% of total value added in market services.



Portugal – EU-10
Krugman index: 1980: 0.40; 2006: 0.44

Spain – EU-10
Krugman index: 1980: 0.33; 2007: 0.31



Italy – EU-10
Krugman index: 1980: 0.19; 2007: 0.19

Fig. 6: Gross value added shares in market services industries (Differences relative to the EU-10, GVA at constant 1995 prices, in percent)

Note: The Krugman index is defined as $K_j(t) = \sum_i |S_j^i(t) - \bar{S}^i(t)|$, where $S_j^i(t)$ is the share of sector i in country j at time t based on gross value added at constant 1995 prices, and $\bar{S}^i(t)$ is the share of sector i in the EU-10.

Source: EU-KLEMS Database, Nov. 2009

Interestingly enough, a major source of divergence relative to the EU in the three economies during the period under study is found in business services, which, according to recent literature in the field, have become increasingly important sources of innovation, product differentiation and productivity growth (e.g., Peneder et al., 2003, Rubalcaba and Kox, 2007). The gap relative to the EU, which is considerably large in Portugal and Spain, is most likely related to the aforementioned features of goods producing industries' in these countries. Being strongly biased towards low-skill and low-tech activities, these industries generate a

lower demand for technical and organizational consultancy services, which conveys an additional explanation for the stronger decline in productivity growth in these countries.¹⁴

Focus is now brought to bear on the performance of market services industries by analyzing the contribution of each sector to overall labour productivity growth (cf. Table 5). Following a standard practice in the literature, the analysis is undertaken considering three distinct groups: distribution services, including wholesale and retail trade, transport and storage; finance and business services, including financial intermediation and the renting of machinery and equipment and other business activities; and finally, personal services, including hotels and restaurants, and community, social and personal services.

Table 5: Contributions of distribution, finance and business, and personal services to aggregate **market services labour productivity growth**, 1980-2007 (annual average rates, in percentage points)

	Italy		Portugal		Spain		EU-10	
	1980-95	1995-07	1980-95	1995-06	1980-95	1995-07	1980-95	1995-07
Market services labour productivity	0.0	0.0	3.4	1.3	1.1	0.7	1.5	1.2
Distribution services contribution	-0.2	0.2	1.7	0.3	0.8	0.4	1.2	0.8
from factor intensity growth	-0,1	0,1	1.2	0.4	0.9	0.9	0.5	0.5
from multifactor prod. growth	-0,1	0,1	0.5	-0.1	-0.1	-0.5	0.7	0.3
Finance and business services contrib..	0.1	-0.2	0.3	1.1	-0.3	0.5	0.1	0.2
from factor intensity growth	0,0	-0,2	0.1	0.1	0.4	0.4	0.6	0.4
from multifactor prod. growth	0,1	0,0	0.1	0.9	-0.7	0.1	-0.4	-0.2
Personal services contribution	0.1	-0.1	0.5	-0.1	0.2	-0.2	-0.1	-0.1
from factor intensity growth	0,0	0,1	0.4	0.1	0.9	0.4	0.2	0.1
from multifactor prod. growth	0,1	-0,2	0.1	-0.3	-0.7	-0.7	-0.2	-0.1
Contribution from labour reallocation	0.0	0.1	0.9	0.1	0.3	0.1	0.3	0.2

Sources: EU-KLEMS Database, Nov. 2009 and INE for Portugal; EU-KLEMS Database, Nov. 2009, for Spain and the EU-10. Numbers may not sum up exactly due to rounding.

Notes: 1) The computation of TFP growth in market services industries in Portugal uses the capital input series described in Table A.1. For the 1980-1995 period, those series are only available for the broad 60-64 and 65-74 sectors, which means that the decomposition between factor intensity and TFP growth in these cases was made including post and telecommunications in distribution services, and real estate in finance and business services. 2) Portuguese TFP measures should be seen as upper bound estimates, relative to those presented for Spain and the EU, since no labor composition changes are available at the industry level.

The evidence reported in Table 5 shows that the main factor accounting for the decrease in market services labour productivity growth in Portugal, Spain and the EU derives from the contribution of distribution services, which shows an impressive decline (in Italy, there is virtually no contribution from market services industries). This decline was particularly acute

¹⁴ In the Portuguese case, this period was also marked by an impressive rise of the financial intermediation sector, which experienced extensive deregulation, particularly after Portugal's entry in the EU (cf. Pinho, 1999; Tavares Moreira, 2000). This sector also rose in importance in Spain, but to a much lesser extent.

in the case of Portugal, from 1.7 p.p. in 1980 to 0.3 p.p. in 2006, and to a lesser extent, in Spain, from 0.8 to 0.4 p.p., explaining therefore the greater fall in productivity growth in these two countries.

In all cases, the major reason behind this decline is found in the fall in multifactor productivity growth, although the variation in factor intensity also played a part in the case of Portugal. It seems therefore that one of the key factors outlined in the literature to explain the rise in the productivity growth differential between Europe and the United States, that is, the lower productivity performance in distributive trade in Europe (c.f. van Ark et al, 2008; Inklaar et al., 2008), may also provide an explanation for Italy, Portugal and Spain's slower rate of convergence with the EU since 1995. The reasons usually put forward to explain this sector's poor performance in Europe also seem to apply in this case. The three countries have rather restrictive product market regulations, such as strong measures in the retail sector (cf. Conway et al., 2005; OECD, 2010a; OECD, 2010b), which are generally regarded as constraining firms in the ways they can innovate and improve processes, thus inhibiting productivity growth.

In contrast with the Italian and the EU core experiences, the contribution of the financial and business sector evolved rather positively in Portugal and Spain, reflecting important gains in multifactor productivity growth.¹⁵

4. Key factors behind the slow change towards a more “modern” productive structure: an exploratory analysis

The overall evidence displayed in the previous sections shows that despite the transformations observed in South-western Europe during the past three decades, no substantial convergence has been reached with respect to the average EU production structure. The three countries under study remained more specialized in low-skill and low-tech activities, which conditioned their growth paths.

We now go a step further, analysing the observed changes in countries' productivity and economic structures in the light of the broad transformations that took place in the political and economic background.

¹⁵ In both countries the financial intermediation sector experienced substantial transformation during the period considered, due to increased deregulation and competition (cf., Pinho, 1999; Tavares Moreira, 2000; Vives, 1990; Kumbhakar and Lozano-Vivas, 2005), along with strong technological improvement. International comparisons on banking system efficiency show that Portugal and Spain compare well with other European countries, in contrast with many other industrial branches, in which a strong productivity gap persists (e.g., Lozano-Vivas et al, 2002; Erber and Madlener, 2008).

During the period under study, Italy, Portugal and Spain experienced increased openness and integration of factor and product markets with the construction of the Single Market and the inception of the Economic and Monetary Union. The overarching impact of such transformations surely has had an influence over the sectoral composition of their economies.

As seen in Figure 7, in the three economies there was a global increasing trend in the export share in GDP, although it has practically stalled since the mid-1990s. In fact, the more recent years were marked by the decline in competitiveness of south-western European economies, as shown by the increase in the real effective exchange rates (cf. Figure 8) and in the deterioration of trade and current accounts (Jaumotte and Sodsriwiboon, 2010).

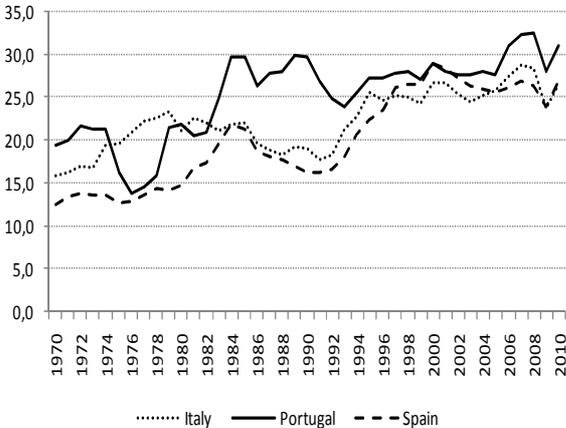


Fig. 7: Export share in GDP, current prices

Source: OECD, International Trade Database

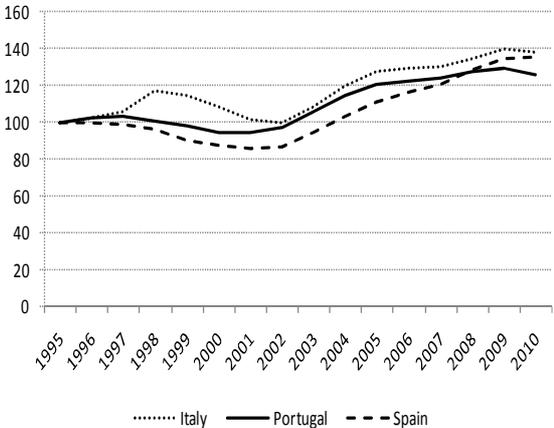


Fig. 8: Real effective exchange rates (index, 1995 = 100)

Source: Eurostat

The analysis of the composition of exports shows, at the same time, that a movement of convergence with the EU-10 export structure came into place (cf. Table 6). Notwithstanding, substantial differences remain in the three countries’ export structures relative to the EU-10. The share of very low-skill exports is still about three times higher than the EU-10 average in the case of Portugal, and supplier-dominated industry exports shares are twice the European level. In Spain and Italy, the shares of low-skill and low-tech activities are also considerably higher than the EU.

Accordingly, the analysis of revealed comparative advantages on the basis of Balassa indices indicates that the three countries are still more competitive in low-tech and low-skill products (with the exception of Italy in specialized supplier products), presenting a clear comparative disadvantage in high-skill and high-tech products. The potential role that economic integration could have had in reducing relative specialization seems therefore to have been

rather limited in practice, which provides an explanation for the observed slow transformation of the economic structure.¹⁶

Table 6: Exports by skill, innovation and technological intensity, 1980-2007 (shares in exports and Balassa indices)

	Export shares								Balassa indices ¹					
	Italy		Portugal		Spain		EU-10		Italy		Portugal		Spain	
	1980	2007	1980	2007	1980	2007	1980	2007	1980	2007	1980	2007	1980	2007
Skills														
Very low (1)	20.6	14.0	42.1	20.3	19.5	12.1	11.8	7.6	1.7	1.8	3.6	2.7	1.6	1.6
Low (2)	19.7	20.4	19.0	22.0	31.3	21.9	22.5	18.6	0.9	1.1	0.8	1.2	1.4	1.2
(1) + (2)	40.3	34.3	61.1	42.2	50.8	34.0	34.3	26.3	1.2	1.3	1.8	1.6	1.5	1.3
Medium-low	8.6	8.3	3.9	6.8	4.9	5.0	5.3	5.5	1.6	1.5	0.7	1.2	0.9	0.9
Intermediate	30.4	36.3	14.4	28.3	27.7	37.1	33.3	35.5	0.9	1.0	0.4	0.8	0.8	1.0
Medium-high (3)	18.4	20.5	19.8	20.9	15.5	23.3	25.3	30.2	0.7	0.7	0.8	0.7	0.6	0.8
High (4)	2.2	0.5	0.8	1.8	1.1	0.5	1.8	2.6	1.3	0.2	0.4	0.7	0.6	0.2
(3) + (4)	20.7	21.0	20.6	22.6	16.6	23.8	27.1	32.8	0.8	0.6	0.8	0.7	0.6	0.7
Innovation														
Supp.-dominated	28.5	21.0	51.6	26.0	25.5	16.4	17.9	12.9	0.8	0.9	2.9	2.0	1.4	1.3
Scale-intensive	36.3	36.0	30.3	41.8	49.7	52.7	45.2	41.5	0.6	0.6	0.7	1.0	1.1	1.3
Spec. supplier	25.0	29.7	8.2	18.6	14.5	13.1	20.8	25.1	1.2	1.2	0.4	0.7	0.7	0.5
Science-based	10.2	13.3	9.9	13.6	10.3	17.7	16.0	20.5	1.6	0.6	0.6	0.7	0.6	0.9

Source: CHELEM database.

Notes: 1) Balassa indices computed as $B_{ij} = \frac{x_{ij}/x_i}{x_{EUj}/x_{EU}}$, where X represents exports of product j with origin in country i . and the EU-10 is taken as the reference area. 2) Computations comprise all sectors reported in CHELEM, including activities from agriculture, manufacturing and services.

The impact of increasing economic integration has probably been stronger within each country, by promoting an adjustment in production to changes in domestic demand. The greater difficulties faced by the three countries in the external market due to the loss of competitiveness, and to the more intense competition from abroad in “traditional” industries, stemming from the EU enlargement and the increasing trade liberalization under WTO agreements, were partly offset by turning to less exposed business areas. In practice, it stimulated the redeployment of production factors to the non-tradable sector and to sectors more sheltered from international competition (e.g., construction, utilities, personal and distributive services), which, as indicated earlier, was responsible for a more stronger deterioration of productivity growth in the three economies.

¹⁶ Although economic theory does not provide a clear-cut indication about the nature of the impact of economic integration on the countries’ specializations, some views expressed within imperfect competition (Krugman, 1980) and new economic geography models (e.g., Krugman, 1991; Fujita et al, 1999) suggest that it can promote intra-industry trade, originating the convergence of productive structures across countries.

This process was facilitated, at the same time, by the decline in interest rates associated with the EMU process (Micossi, 2012). The reduction in the cost of financing stimulated an increase in private indebtedness in the three countries, which lies at the heart of the construction boom in Spain and which is also related to the strong increase in the “production” of the financial intermediation sector in the case of Portugal.

Along with these changes in demand, an additional factor from the supply side can also explain the slow change in structure observed in the three economies. Between 1980 and 2007, important improvements in educational attainment were reached in Italy, Portugal and Spain. School enrolment increased considerably with the lengthening of compulsory schooling in the three countries, and the coverage of early childhood education and participation rates in tertiary education rose markedly as well (Guichard and Larre, 2006; Fuentes, 2009; OECD, 2011). A relative shortage of human capital persists, however, and is particularly problematic in the case of Portugal. Portugal still has one of the least qualified workforces in the OECD countries, ranking next to Turkey and Mexico. The situation of Italy and Spain is better in this domain, but the supply of unskilled workers remains very high, due in part to the influence of middle-age cohorts, but also to the maintenance of a large inflow of unskilled youth into the labour market (cf. Fuentes, 2009; Checchi, 2003). Early dropout rates are among the highest in the EU, and the OECD PISA comparisons of education outcomes performed in 2007 rank the three countries below the average in all the competencies assessed (cf. Table 7).

Table 7: Education indicators, 1980-2007

	Italy	Portugal	Spain
Av. years of schooling of the working age population			
1980	7.3	6.9	6.3
2007	10.2	8.5	11.2
Upper secondary graduation rate			
2007	85%	65%	74%
Rank (out of 30) in PISA mean scores (2007)			
Science	26	27	23
Reading	25	24	27
Mathematics	27	26	24

Sources: Data on average years of schooling for 1980 are taken from Bassanini and Scarpetta (2001). The 2007 figures are computed considering data on educational attainment and cumulative years of schooling by educational level from OECD *Education at a Glance* (2009). Data on upper secondary graduation rates and countries’ PISA results are also taken from *Education at a Glance* (2009). Countries’ ranks are computed considering the total number of OECD countries (30).

Note: OECD average: 82%

The relatively low educational level of the population has inevitably an impact on the composition of economic activity. It explains to some extent why firms remain stuck in low-productivity activities and do not adopt more advanced technologies. Indeed, a large supply of high-skilled labour seems to be a prerequisite to promote significant structural change, by enabling the adoption and creation of technology and stimulating innovation. As a consequence, education influences structure, but the inverse relationship is plausible as well. Studies focusing on the relationship between education and employment (OECD, 2005), show that in some cases early dropout rates are motivated by the relative ease with which young, poorly-qualified workers are able to get unskilled jobs. This is the case in Portugal, where unemployment rates during most of the period under study were relatively low, and also in some regions in Spain and Italy, particularly those in which tourism plays an important role in economic activity. In this case, a vicious circle between low education attainment and low-tech industry structure seems to have been in place, making it more difficult to implement the modernization of the economy and promote its adaptation to global competition.

5. Conclusion

“...the greater danger lies not with entirely practical men or women exempt from any intellectual influence, but with the reasonably intellectual men and women who are employed in the policymaking functions of central banks, regulators, and governments ... who tend to gravitate to simplified versions of the dominant beliefs of economists who are not yet defunct but still very much alive.” (Turner, 2010: 1320)

The Eurozone sovereign and banking crisis, following the onset of the subprime tremors in July 2007, the nationalization of Anglo Irish in January 2009 and culminating with the evidence of the Greek sovereign's distress in May 2010, collected considerable attention from both public opinion and academia (Mody and Sandry, 2012). However, accounts on the Eurozone fiscal and financial crises have been paved by a (over)simplistic analysis on the limits of fiscal support for domestic banks and financial sector's prospects. A considerable number of studies (e.g., Echinard and Labondance, 2010; Fernandes and Mota, 2011) resort to the so-called GIPS (Greece, Italy, Portugal, and Spain) for addressing issues such as the problem of national public finances, namely its mismanagement, the collapsing European economic governance, and the concomitant lack of trust of international financial markets towards European sovereign debts.

In this line, and as to overcome southern European ‘incompetence’ or inability to rein in debt and cut its fiscal deficit, stabilization plans, underwritten by the International Monetary Fund

(IMF), the European Central Bank (ECB) and the European Union (EU) – known as Troika –, came into scene. Under these programs Ireland, Greece and Portugal received considerable financial help in an effort to bring down the ballooning budget as well as the yawning current account deficit. The main policy measures associated with the ‘austerity programs’ involved cuts in government spending, most notably through substantial cuts in pensions and public-sector wages, and increases in government revenues, namely through increases in the VAT and other taxes. The cuts were also expected to contribute to an improvement in competitiveness through a fall in demand and the resultant fall in domestic prices.

The problem with these ‘austerity plans’ is that they fail to address a more complex, structural and hidden problem of these economies. As earlier recognised by Tortella (1994: 18), “... fiscal mismanagement, although still considerable, is less serious, in relative terms...”, and underlined, more recently, by Antzoulatos (2011), the root cause for the crisis lies well behind in the past, preceding the recent financial and fiscal imbalances. It is connected with the loss of competitiveness, reflected in the deteriorating current account deficit, and the internal shift of economic resources against tradable goods and services. In a nutshell, the roots of the crisis that has been affecting South-western Europe lie on ‘real economics’, structural change processes.

Several historical accounts document the processes of growth and structural fragilities of South-western European countries (Italy – Andreopoulos, 2007; Saltari and Travaglini, 2009; Portugal – Baklanoff, 1979; Lains, 2003, 2008; Teixeira and Fortuna, 2010; Spain – Balaguer and Cantavella-Jordá, 2004; Sánchez Chóliz and Duarte, 2006, Prados de la Escosura and Rosés, 2009). Despite the scientific relevance of such contributions for the knowledge of the roots of the economic backwardness of these economies vis-à-vis their western and northern European counterparts, the analysis of the historical paths countries is performed considering each country separately. From our perspective, the patterns of economic evolution and structural change might be better understood if we adopt a regional viewpoint that go beyond the country’s specificities. Adopting such a perspective, in the present paper we provide an interpretation of productivity trends in south-western Europe between 1980 and 2007, focusing on long term, structural change processes.

We demonstrate that several traits were common to South-western European economies:

- 1) Italy, Portugal and Spain experienced a decline in productivity growth after 1995, which was more intense than at the broad European level, leading to stagnation in the case of

Portugal, and divergence, in the cases of Spain and Italy. In other words, there was an economic crisis previous to the emergence of a financial crisis.

2) Growth accounting exercises show that multifactor productivity growth was the main source of the productivity slowdown, decreasing considerably in the three countries.

3) The sectoral composition of the three economies, which maintain a bias towards low-skill and low-tech activities seems to provide a convincing explanation for the stronger deterioration in MFP growth.

4) Competitiveness problems, in a context marked by increasing economic integration and the maintenance of a plentiful supply of low-skilled labour seems to lie at the basis of the observed changes in goods-producing and market services industries, which were globally conducive to an increasing relevance of the non-tradable sector of the economy.

Looking at the historical economic paths of south-western European countries, it is apparent that the present crisis was not unforeseen. Contrary to the idea created by the stabilization programs' immediate focus on restoring fiscal balance, the roots of the crisis lie in the eroding international competitiveness of the countries. The lack of comprehensive policy measures to restore competitiveness over the medium-to-long term and encourage the redeployment of production factors to the tradable sector do not anticipate much success for the ongoing austerity plans. The solution to overcome the economic retardation would inevitably require export-led growth which, in turn, demands building a more competitive economy. The restoration of economic competitiveness involves the definition of medium and long term policies, focusing on the redeployment of labour and other factors towards tradable goods production, indigenous innovation commitment and high quality and democratised human capital investment. In other words, it requires the design of an adequate industrial policy.

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APPENDIX

Measurement of Capital Services Growth

Capital services were estimated using the method pioneered by the United States Bureau of Labor Statistics (BLS), described in detail in Silva (2010). Differently from Silva's original estimates, in the present case, the geometric age-efficiency decline was used, rather than the hyperbolic profile, in order to obtain greater comparability with the EU-KLEMS estimates. Depreciation rates were also taken from the EU-KLEMS database (November 2009 release). Because this database considers a larger number of assets than those available in the Portuguese National Accounts, in particular in the case of machinery and equipment, which is divided into three different assets (information technology equipment, communication technology equipment, and other machinery and equipment), the depreciation rates used were obtained as the weighted average of the depreciation rates of the different assets, using as weights the shares of the assets in the total capital stock in Spain during the period under analysis.

Relative to Silva's (2010) estimates, there were also some refinements which were now made possible given the wider availability of data. First, the original computations regarding the 2001-2003 period were based on provisional data from INE, and now we were able to use the definitive series and extend them to cover additionally the years between 2004 and 2006. Moreover, INE made some refinements in the more recent data and retropolated them with respect to the earlier period (from 1995 onwards), which led to some adjustments to the earlier series. The breaks in the 1980-1995 series, more precisely in 1988 and 1995, were solved by using the information contained in overlap years. Also, differently from Silva (2010), we used the deflators from INE by sector and asset type from 1995 onwards; for the earlier period, because that information is not available we consider the deflators differentiated only by asset type. Another refinement refers to the calculation of labour and capital shares in total income. In this case, the "mixed income" component was allocated to labour and capital shares, using data on employees and self-employed, as suggested in OECD (2001, p. 45). Capital input series were determined for the 26 sectors reported in Table A.1. The determination of capital services for higher level aggregates, such as the economy, was computed as follows:

$$\Delta \ln K_t = \sum_i \bar{w}_{it}^K \Delta \ln K_{it}$$

Where \bar{w}_{it}^K is the period-average share of industry i in total economy capital compensation.

Table A.1: Volume index of capital services by sectors, Portugal (1979-2006)

	A+B	CA+CB	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM
1979	56.1	61.7	60.6	55.3	42.1	101.8	46.0	69.4	116.7	53.2	54.6	70.7	60.0	48.8	30.4
1980	63.2	69.0	62.9	56.6	45.9	108.8	46.7	67.0	122.6	58.4	56.0	74.8	63.2	52.3	31.6
1981	74.4	80.4	65.7	61.7	53.8	114.2	51.9	64.9	123.3	64.5	57.8	79.6	69.0	57.9	35.2
1982	79.2	95.1	68.9	65.4	57.9	114.3	55.0	62.0	126.7	70.3	64.7	86.4	76.3	64.9	49.2
1983	80.0	102.1	71.4	67.4	61.2	112.1	67.8	55.5	127.7	71.6	68.0	90.0	80.1	68.8	50.3
1984	80.4	104.5	73.1	68.3	63.9	107.5	68.0	49.6	128.3	73.3	68.9	88.7	84.5	72.9	48.5
1985	78.5	105.4	74.2	69.6	65.8	102.5	67.4	44.5	123.8	74.6	69.6	87.5	84.6	73.8	47.1
1986	77.7	104.5	76.0	72.4	69.4	101.6	69.3	41.3	118.9	76.6	72.5	84.3	84.4	74.0	45.9
1987	79.5	96.7	79.8	78.8	76.1	104.2	74.3	39.1	115.4	81.2	76.9	83.2	86.0	76.1	46.5
1988	95.4	104.9	81.2	85.4	78.9	101.9	81.8	37.7	113.4	84.9	81.6	89.6	88.8	79.9	48.7
1989	110.5	111.1	85.5	93.5	86.5	106.1	87.6	36.9	111.4	91.5	86.0	92.3	91.5	83.2	50.5
1990	111.3	115.3	89.7	100.6	94.7	108.5	94.1	41.6	108.4	97.2	92.7	99.4	95.0	88.5	54.0
1991	111.1	118.1	93.6	103.1	102.0	110.7	101.5	46.0	106.4	100.2	96.2	103.4	98.6	94.1	59.7
1992	105.3	112.4	95.5	102.5	102.0	107.8	101.4	73.6	104.8	100.8	98.1	103.1	99.4	96.1	69.5
1993	101.3	106.9	96.5	101.2	101.3	104.2	100.3	95.4	102.9	100.4	98.9	101.9	99.3	97.0	77.2
1994	100.1	102.8	98.2	100.0	99.5	101.6	99.8	96.0	101.1	99.5	99.2	101.1	99.6	98.4	88.6
1995	100.0														
1996	101.8	100.7	103.7	100.1	101.3	101.2	102.7	93.1	99.5	102.2	101.0	98.3	101.2	101.9	111.3
1997	108.6	103.8	106.8	101.4	103.4	100.1	109.1	97.8	102.3	106.4	102.2	99.2	102.1	105.4	121.1
1998	95.9	106.7	110.5	103.8	106.2	100.6	114.9	90.8	104.1	111.0	103.8	100.9	105.3	111.0	131.7
1999	77.1	110.8	115.6	105.9	108.6	106.9	124.7	83.8	106.9	118.6	107.4	104.3	108.9	116.3	141.9
2000	76.2	114.6	121.4	108.1	112.8	118.2	135.0	83.3	109.4	128.0	111.9	110.2	111.3	120.9	151.0
2001	76.4	117.4	126.2	110.4	111.9	125.8	145.7	91.7	110.0	137.7	114.5	114.6	113.1	125.6	160.2
2002	71.7	111.9	131.8	108.6	108.2	132.4	153.1	77.4	112.1	146.5	116.6	115.7	113.4	127.7	167.4
2003	69.6	103.4	135.7	106.0	104.0	134.5	159.3	61.4	111.7	148.9	115.9	116.6	113.9	130.0	171.8
2004	68.1	97.3	139.4	102.8	99.8	133.5	163.8	57.2	111.3	152.3	117.2	119.1	113.6	130.9	175.2
2005	68.2	93.1	142.6	98.6	95.5	133.0	169.1	56.5	111.3	157.9	118.5	122.6	112.9	131.0	180.5
2006	67.4	91.5	145.3	94.3	91.3	131.1	173.1	55.6	111.3	162.0	119.9	126.0	111.5	129.8	185.2

Table A.1 (continued)

	DN	E	F	G	H	I	J+K	L	M	N	O-P	60-63	J+71-74	Economy
1979	103.5	47.9	54.4	34.4	29.1	82.6	43.6	31.9	33.1	38.7	16.3	-	-	48.9
1980	109.5	49.0	58.0	36.6	31.6	84.4	45.7	33.6	34.8	41.0	17.8	-	-	50.9
1981	114.7	48.7	63.3	38.6	33.2	87.2	47.8	35.7	36.7	45.3	19.1	-	-	52.8
1982	119.6	49.1	66.7	41.1	40.3	89.0	50.2	37.7	39.1	48.2	21.5	-	-	55.9
1983	120.6	50.2	64.2	42.7	43.5	93.0	51.9	39.3	41.2	49.7	22.8	-	-	58.3
1984	117.5	51.6	60.0	43.5	44.3	94.3	53.2	40.4	42.8	50.7	23.0	-	-	59.3
1985	112.7	59.1	57.5	43.8	45.0	93.3	55.8	43.1	45.7	52.9	23.5	-	-	60.7
1986	109.5	64.1	55.8	45.5	47.5	93.3	59.0	46.9	47.0	54.5	25.1	-	-	62.7
1987	109.4	72.2	57.5	49.1	50.7	96.2	62.8	50.8	51.0	56.6	27.5	-	-	66.4
1988	107.1	82.0	61.7	52.9	54.0	97.0	66.8	55.6	55.4	61.3	32.4	-	-	69.9
1989	109.2	87.4	67.2	57.2	60.9	97.4	71.2	60.3	59.5	54.9	36.8	-	-	73.7
1990	109.9	87.4	71.1	64.1	67.3	98.4	76.5	65.8	63.8	58.8	42.4	-	-	78.6
1991	110.2	85.9	77.3	71.5	75.4	98.5	81.7	71.9	69.7	65.0	49.4	-	-	83.6
1992	106.6	85.9	83.8	79.5	81.8	98.2	87.4	79.9	79.3	75.8	62.9	-	-	87.9
1993	102.6	85.7	88.2	85.6	86.7	97.6	92.3	87.0	87.4	84.2	73.6	-	-	91.8
1994	101.0	95.0	94.1	92.5	91.5	98.7	96.5	92.8	92.4	91.7	81.5	-	-	95.9
1995	100.0	100.0												
1996	102.1	101.5	105.6	108.5	107.4	100.9	103.9	110.7	107.7	106.4	114.5	100.6	107.1	104.4
1997	103.5	109.5	112.5	117.0	116.0	103.0	108.6	121.1	118.6	115.7	129.2	103.3	115.5	109.9
1998	106.2	110.9	122.5	127.4	123.3	108.9	113.8	130.9	132.8	128.0	145.6	111.2	125.0	116.2
1999	111.3	119.4	131.6	137.5	133.1	113.8	119.1	142.3	164.1	142.4	160.2	118.4	134.2	123.5
2000	118.1	127.3	141.2	148.0	141.7	117.6	124.0	151.0	190.8	156.5	175.6	123.8	141.4	130.4
2001	120.4	132.7	145.0	156.3	148.7	122.0	128.6	159.9	207.3	168.4	192.5	129.7	147.0	136.2
2002	122.2	137.4	142.6	163.3	156.8	125.8	132.9	167.8	221.4	178.5	210.7	134.7	152.5	141.3
2003	121.3	143.3	138.6	168.7	160.5	128.7	136.4	175.1	228.5	186.9	226.0	139.4	157.9	145.2
2004	120.0	150.0	137.1	172.2	164.1	131.6	139.7	183.4	236.8	191.3	240.2	143.4	162.9	148.7
2005	119.7	160.7	133.8	175.8	167.3	134.3	142.8	190.5	243.6	195.8	252.6	147.6	168.4	152.2
2006	122.4	172.6	129.2	180.6	170.6	137.6	145.9	195.5	250.1	203.9	263.9	152.8	171.6	156.1

Table A.2: Classification of sectors according to the selected taxonomies

Industries	Peneder (2007)	Tidd et al. (2005)
01 Agriculture	Very low	Supplier-dominated
02 Forestry	Very low	Supplier-dominated
05 Fishing	Very low	Supplier-dominated
10-14 Mining and quarrying	Medium	Scale-intensive
15-16 Food, drink & tobacco	Low	Scale-intensive
17 Textiles	Very low	Supplier-dominated
18 Clothing	Very low	Supplier-dominated
19 Leather and footwear	Very low	Supplier-dominated
20 Wood & products of wood and cork	Very low	Supplier-dominated
21 Pulp, paper & paper products	Medium	Supplier-dominated
22 Printing & publishing	Medium	Supplier-dominated
23 Mineral oil refining, coke & nuclear fuel	Medium-high	Scale-intensive
24 Chemicals	Medium-high	Science-based
25 Rubber & plastics	Medium-low	Specialized supplier
26 Non-metallic mineral products	Low	Scale-intensive
27 Basic metals	Low	Scale-intensive
28 Fabricated metal products	Low	Scale-intensive
29 Mechanical engineering	Medium	Specialized supplier
30 Office machinery	High	Specialized supplier
313 Insulated wire	Medium	Specialized supplier
31-313 Other electrical machinery and apparatus nec	Medium	Science-based
321 Electronic valves and tubes	Medium-high	Specialized supplier
322 Telecommunication equipment	Medium-high	Specialized supplier
323 Radio and television receivers	Medium-high	Science-based
331 Scientific instruments	Medium-high	Specialized supplier
33-331 Other instruments	Medium-high	Specialized supplier
34 Motor vehicles	Medium	Scale-intensive
351 Building and repairing of ships and boats	Medium-high	Scale-intensive
353 Aircraft and spacecraft	Medium-high	Scale-intensive
352+359 Railroad equipment and transport equipment nec	Medium-high	Scale-intensive
36-37 Furniture, miscellaneous manufacturing; recycling	Medium-low	Supplier-dominated
40-41 Electricity, gas and water supply	Medium	Scale-intensive
45 Construction	Low	Supplier-dominated
50 Sale, maintenance and repair of motor vehicles and	Low	Information-intensive
51 Wholesale trade and commission trade, except of motor	Medium	Information-intensive
52 Retail trade, except of motor vehicles and motorcycles; repair	Medium-low	Information-intensive
55 Hotels & catering	Very low	Supplier-dominated
60 Inland transport	Medium-low	Information-intensive
61 Water transport	Medium-low	Information-intensive
62 Air transport	Medium-high	Information-intensive
63 Supporting and auxiliary transport activities; activities of travel	Medium	Supplier-dominated
64 Communications	Medium	Information-intensive
65 Financial intermediation, except insurance and pension funding	High	Information-intensive
66 Insurance and pension funding, except compulsory social	Medium-high	Information-intensive
67 Activities auxiliary to financial intermediation	Medium-high	Information-intensive
70 Real estate activities	Medium	Information-intensive
71 Renting of machinery and equipment	Medium	Information-intensive
72 Computer and related activities	Very high	Specialized supplier
73 Research and development	Very high	Specialized supplier
741-3 Legal, technical and advertising	High	Specialized supplier
749 Other business activities, nec	High	Information-intensive
75 Public administration and defence; compulsory social security	Medium-high	Non-market services
80 Education	Very high	Non-market services
85 Health and social work	Medium-high	Non-market services
90-93 Other community, social and personal services	Medium-high	Supplier-dominated
95 Private households with employed persons	Very low	Supplier-dominated
9 Extra-territorial organizations and bodies	Very high	Non-market services