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ABSTRACT- The dynamic effects of Foreign Direct Investment in Portugal allowed for a structural shift in exports towards technology-intensive activities. However, since 2000, several factors, largely triggered by the global financial crisis, led to a drop in industrial output along with a reduction in FDI attraction. This paper assesses the efficacy of the Investment Promoting policies to stimulate innovation and promote the absorptive capacity at national level, by analysing the relationship between FDI inward flows and a set of innovation and absorptive capacity indicators. Results show that the gap between Portugal and the EU-28 average is far from being closed. Rather than being an automatic process triggered by foreign presence, we suggest that the convergence based on the productivity, can be assisted by a reinforcement of supply-side measures, and the coordination between the industrial policy and the instruments of the Investment Promotion Policy, in strategic industries.

Keywords: Industrial Policy, Productivity, Investment Promotion Policies, Innovation, Convergence, Technological Gap

JEL Codes: F15, F23, O11, O33, O40

1. INTRODUCTION

After World War II, the Portuguese economy started a process of industrialization, first based on an import substitution policy, which was followed in the 1960s by export promotion policies along with an increasing openness to international trade. Industrialization supported by public and private investments accelerated convergence to the technological frontier. In the 1960-1990 period, the second most important source of growth was the 'catching-up effect' (1.4%), followed by investment in physical capital (2.1%) [Pessoa, 1998]. Indeed, the increasing openness of the economy contributed to an increase in the productivity of manufacturing industries through access to up-to-date technology, disembodied technology and non-technological innovation, alongside with the movement of workers from agriculture to manufacturing industries. In this process of structural change in terms of production, employment and demand, many low-productivity activities were reduced or disappeared. In turn, the economies of scale, provided by output growth, encouraged technical progress. This effect, combined with an export-promotion policy allowed an average rate of growth of real GDP per capita of 4.31% over the period 1961-1989, the third highest recorded in OECD, after South Korea and Japan. However, its evolution was not constant over time. The economy grew more intensely in the 1960s (5.65%) than in the following decades (4.40% and 3.01%, respectively). In fact, as the country approached the technological frontier, because of economic integration in EFTA and the EEC, the relative contribution of the catching-up effect was diminishing. On average, the contribution of the TFP to the growth rate of GDP declined from 1.7% to 1.2% from the 1960's to the 1980's, dropped sharply to 0.2% in the 1990's; and turned negative after 2000 (-1.2% for the first 10 years and -1% afterwards until 2015). In the 1990's real GDP per capita grew on average at a lower rate of 3.19% (reporting a negative growth rate of -0.81 in 1993), and, after 2000, the scenario completely changed with average annual growth rates of 0.60% in 2000-2009 and -0.22% in 2010-2016. Simultaneously, China's entry into the World Trade Organisation in 2001, the increased foreign competition arising from the EU enlargements and the international financial crisis, slowed the pace of annual growth of real GDP per capita to 0.71% in the first ten years of the new millennium. Thus, the European integration of Portugal was marked by a gradual erosion of competitiveness of the economy and a worsening of the external accounts, due to several factors, namely, the successive increase in the labour cost; the resurgence of competition in the international markets; the expansion of domestic demand and a financing structure that favoured the public sector over the private sector; the high imported components and the low technological content of exports. Indeed, in 2001-2016, high tech exports accounted, on average, for only 5% of total exports.

Being a moderately innovative economy (Innovation Union Scoreboard, 2011), without the location advantages of the CEECs, the potential of convergence of the Portuguese economy, since 2005, was largely threatened by an average growth rate of Total Factor Productivity (TFP) of only 0.28% in 2005-2010. Indeed, in 2005-2014, GDP slumped into an average negative growth rate (-0.3%), with *TFP* accounting for -1.1% of this decline. Notwithstanding, historically the role of manufacturing labour productivity has been important. In 1986-2016, the productivity per worker is on average twice of that of services and three times higher than that in agriculture. In addition, in the last 30 years, Portugal has quadrupled the share of resource allocation to R&D activities, from 0.4% of GDP in 1986 to a maximum of 1.6%, in 2009. However, the effects of technological improvements on growth have not been translated into real *convergence* (measured by *real GDP* per capita) of Portugal towards the EU-28 level (Mateus, 2015). The difficulties in the convergence

process were evident in the evolution of net revenues from Community Structural Funds (CSF), which increased from 1% of GDP in 2007 to over 2% in 2013, while the average net revenues in the four "cohesion countries" remained around 0.5% of GDP.

It has been argued that the cause for non-convergence was the investment and the allocation of resources (labour) towards non-tradable services to the detriment of the manufacturing sector where the innovation indices are higher; as well as the implementation of structural reforms (OECD, 2013). The attempts to increase competitiveness based on wage flexibility instead of investment in new products and production processes contributed to revoke the potential positive effects from the R&D efforts. In addition, being a small open economy located on the European periphery, Portugal is vulnerable to external factors that undermine economic growth.

Historically, FDI has contributed significantly to economic growth, by strengthening the export capacity of domestic manufacturing firms. The share of foreign firms in Portuguese exports represented on average nearly 33% of total exports of the manufacturing sector in 1986-2016. However, the financial crisis caused a drop, not only in FDI flows but also in manufacturing output and employment in Europe, due to several external factors, and the Government incentives for innovation activities have been narrowed in most cases. Following the above summing-up about the main features of the Portuguese growth process under European integration, FDI inward flows seem to play an important role. Our main goal is to evaluate, under a policy perspective, whether FDI inward flows during the last 30 years of European integration have contributed to convergence through increased productivity in the Portuguese manufacturing sector. Accordingly, we analyse several innovation and absorptive capacity indicators, in order to evaluate the efficacy of FDI policies in promoting innovation and increasing the absorptive capacity.

In this framework, the European Commission (EC) plays an important role regarding the Government incentive system for innovation activities in Europe, with a view to improve the competitiveness of firms. The National Innovation System is the flow of technology and information among actors (people and institutions) that shape a Country's innovative process. The linkages (i.e., the set of relationships between agents) can take the form of joint research, personnel exchanges, cross patenting, and purchase of equipment. Understanding these systems can assist policymakers developing approaches for enhancing innovative performance in the knowledge-based economies (OECD, 1997). Furthermore, the EC considers the manufacturing sector as a driver of economic recovery since it potentially generates high rates of innovation and drags capabilities to other sectors of the economy. In this context, industrial policy plays an important role by contributing to the achievement of higher levels of competitiveness through the increase of manufacturing productivity.

Hence, the purpose of this paper is to evaluate from a policy perspective, the impact of FDI inward flows on the TFP of the Portuguese manufacturing sector, through the encouragement of innovation and the increase of absorptive capacity; and thus, on the process of convergence vis-à-vis the EU-28 average.

The presence of the MNCs can provide, for example, technical support to local suppliers in order to improve the quality of inputs or to assist their suppliers in the introduction of innovations and new management techniques, among others (Lall, 1980). In other words, FDI can improve the innovative and the absorptive capacity of domestic manufacturing firms and, thus, it is a vehicle of technological change. Bearing this in mind, we analyse the evolution of FDI and several indicators related to the innovative capability and the absorptive

capacity; and we perform an analysis of the performance of the Portuguese economy regarding the achievement of goals to reduce the gap (technological plan) and to increase the innovative capability and the absorptive capacity (Europe 2020 strategy). The objective of this exercise is to provide some policy recommendations to boost productivity and prompt economic growth.

The paper is organized as follows. Section 2 describes the legal framework and the Public Investment Policy related to FDI in Portugal; Section 3 analyses the evolution of FDI inward flows in Portugal and the Manufacturing performance, as well as a set of indicators of technological change in order to assess the efficacy of FDI policies to promote innovation and its coordination with measures aiming to promote the absorptive capacity; In Section 4 we make some recommendations on the design and implementation of FDI policies in the Industrial context; finally, Section 5 concludes.

2. FDI POLICIES IN PORTUGAL

The economic benefits from attracting FDI are generally positive externalities to the host economy. The channels through which externalities operate are 1) technology transfer and know-how; 2) firm development and restructuring (in relation with privatizations); 3) integration in international trade; 4) enhanced competition; and 5) support for training human capital in the host country (Mercinger, 2003). In developed countries, the first two channels are generally considered the most important ones (OECD, 2002). Policies to attract foreign investors include low tax corporate rates, reducing bureaucracy, preferential tariff arrangements, stepped-up investment in infrastructure and education measures. Many of the tariff arrangements, infrastructure and education measures have been directed to priority economic sectors and regions (in connection with "special economic zones", "export processing zones", etc.). Other measures were aimed at the general strengthening of social capital through subsidies to the final investment. But these strategies cannot be classified as FDI incentives because they encourage private Investment in general, whereas FDI incentives target or give preferential treatment to foreign investors.

Legal Framework. Portugal's accession to the EC was the engine of change in existent foreign investment legislation from 24 August 1977. Indeed, the new legal mechanism was necessary to liberalize the transfer of private capital (in the form of FDI) from the EC countries and non-EU countries. Under the new regime, enshrined in the diplomas of July and August 1986, all economic sectors are open to private investment, regardless of their origin. The 1977 system, which followed the lengthy procedures, was replaced by a prior notification system based on the following characteristics. Before starting operations, the foreign investor should send the investment proposal to the competent national authority; within two months, the authority informs the applicant of its decision; failure to notify the applicant within that period gives the right to start operations immediately. This system was intended to create new jobs, attract foreign currency to reduce the Portuguese external indebtedness and to strengthen the regional development programs. These objectives were reinforced with entry into force in 1995, of the Foreign Investment Code, under which non-

resident firms can create and exercise any economic activity allowed to private sector.[1] It also ensured non-discrimination between domestic and foreign investors. Investors could request state aid for an investment project under a general incentive scheme or under a special contractual regime of foreign investment, in case of involving a certain amount of capital expenditures. The Decree No. 2/96 of 16 May 1996, as amended by Decree No. 4/00 of 24 March 2000 establishes the procedures for submitting such a request; and Ordinance No. 865-A/ 2002 has established the minimum amount of capital associated with the eligible investment: EUR 25 million. Investment projects under this scheme could benefit from financial incentives under operational programs and special tax incentives (in accordance with the Tax Benefits -Article 49a and Decree-Law No. 409/99 of 15 October 1999). Law No. 44/2014, of 11 July, authorized the government to amend the Tax Benefits Statute and to adopt a new Tax Code of the investment that has adapted the European legislative framework for state aid for 2014-2020. This code aims to strengthen the tax-exempt investment schemes, about investments that aim to create or maintain jobs and which are in less-favoured regions. About the contractual tax benefits, the limit of corporate tax credit is extended as well as the credit increases for investments in regions with a per capita purchasing power significantly below the national average, which provide the creation or maintenance of employment or contribute to technological innovation or environmental protection. In November 2014, the Council of Ministers reviewed the contractual arrangements for investment, special procurement system (RCI) incentives applicable to large classifiable investment projects within the jurisdiction of the Portuguese Agency for Investment and Foreign Trade (henceforth AICEP). The RCI allows a special negotiation treatment for these projects and the contracting of a set of incentives. The nature, amount and conditions of the incentives- financial incentives, tax benefits and specific compensatory measures to mitigate the costs - are determined considering the economic impacts of the project, as well as the fulfilment of obligations by the sponsor and the contractually fixed economic targets, through a process led by AICEP mandated by the Government.

Public Investment Policy. According to Law 82-A/2014 which approved the major plan options for 2015, Portugal has implemented a program of structural reforms, aimed to reinforce the dynamism and flexibility of the economy, creating international competitive benefits and the sustainability of the public sector. To attract foreign investment, the areas of public intervention are based on the transparency of public finances, the flexibility of labour market, the speed of court proceedings and liberalization in product markets. In addition, measures have been taken to simplify administrative requirements, to restructure operations and to promote business and to strengthen the management and rationalization skills of bank funds directed to small and medium enterprises (SMEs). In October 2014, the EC approved the establishment of the Financial Development Institute which, as its counterparts in other European countries, channels the structural funds. This institution focus on three areas of intervention with the purpose of promoting economic growth and employment, supporting competitiveness and international presence; and contributing to sustainable development. In the field of innovation, measures were implemented to stimulate business innovation, strengthen the cooperation between firms and scientific and technological organizations and promote the inclusion of doctorates and masters in firms through financial incentives to SMEs. Aimed at creating a favourable environment for entrepreneurship, it was created the new special visa regime for knowledge intensive start-ups based in Portugal. Moreover, the incentives to promote business angels and venture

[1] Decree-Law No. 321/95 of 28 November 1995

capital have been strengthened, with financial support mechanisms and corporate tax incentives for start-ups.

The Industrial Development Strategy for Growth and Employment and The Competitiveness Agenda for Trade, Services and Restaurants 2014-2020 were designed to jointly cover all sectors, create employment and growth opportunities. In this context, fiscal policy is a key instrument in supporting investment, promoting sustainable growth, creating employment and strengthening the capital structure of firms. In 2014, with the aim of turning competitive the country's tax system, the government reformed the corporate Tax (IRC), which included a reduction of tax rates, and approved the new Investment Tax Code. To fight fraud and tax evasion, it was designed the Cash Value Added Tax system that allows the adjustment of loans overdue in more than 24 months from the date of maturity without prior judicial decision. Attention was also paid to the conventions to avoid double taxation, with other European countries, and the negotiations take place with about 40 countries. With the objective of creating a more favourable environment for investment, the government adopted a consolidation and revitalization of the business strategy based on: the simplification of administrative requirements for restructuring operations; development of business promotion actions; creation of business opportunity grants; mergers encouragement; enhance business management skills; and banking capitalization funds for SMEs.[2] At the same time, the creation of a multi-annual training program for new exporters led to the signing of international protocols for the release of intermediated credit lines and guarantees for the financing needed to support the internationalization of SMEs. In the context of this paper it is assumed that the policies and instruments described have been, to some extent, successful in attracting FDI and, indirectly, increase the TFP of domestic manufacturing firms.[3] Furthermore, international empirical studies provide evidence that FDI can improve the innovative capacity of the domestic firms. Though, the magnitude of the effect of FDI on innovation capacity may depend on the absorptive capacity of domestic firms (Fu, 2008).

3. FDI FLOWS TO MANUFACTURING, TECHNOLOGICAL CHANGE AND CONVERGENCE

For the follower economy, the process of catching-up with high-income economies consists in eliminating the productivity gap. Since the convergence process is partly driven by the convergence of TFP with the technological leader economy, identifying the drivers of productivity growth is crucial to understand the sources of the productivity gap.

FDI is believed to generate positive externalities in the form of knowledge spillovers to the domestic economy through, for instance, linkages with local suppliers and clients (backward and forward linkages), learning from nearby foreign firms and employee training programmes. In this context, the manufacturing sector, being a major producer of tradables,

[2] Government provided funds aimed at the fulfillment of capital ratios by banks at a certain level of interest rate and with the guarantee that banks will lend at least part of these funds to SMEs.

[3] Tavares-Lehman (2007) remarks that, although in recent years, Portuguese policy regarding FDI has evolved towards a more proactive and selective stance, the institutional agenda is not prone to maximize the potential benefits of existing investments and macro policies lack consistency. Also, Vinhas de Souza (1996) tested the effects of the regulatory structure upon the amount of the FDI flows to Portugal but the coefficients were not significant and the author could not find a clear sign of granger-causality between legal liberalization and tax policy and the size of the inflows, for 1985-1994. As a result, as Silva (1990) -notes, with the exception of some years in the 1980s, Portugal has never attracted a large amount of FDI flows.

is the main engine of economic growth due to its higher productivity and innovation indices (Andreoni and Gregory, 2013). Furthermore, technological linkages stemming from manufacturing industries are main vehicles of technological change (Jones and Olken, 2005; Rodrik, 2007 and Su and Yao, 2016).

An increased foreign presence within an industry is correlated with the TFP growth of domestic firms through increased speed of technology transfer. Table 1 shows some quantitative results regarding the effect of FDI in the TFP of the manufacturing firms in the host economy. For example, Keller and Yeaple (2009) estimate that, in 1987-1996, a 1% increase in the share of foreign-affiliates' employment in total employment, increases TFP of manufacturing plants in the U.S. by 1.1%. For a panel of OECD Countries, including Portugal, Pessoa (2005) estimates that 1 % increase in FDI have an impact on the TFP of manufacturing firms of about 0.019% – 0.023% in 1985-2002. Using plant level panel data for the UK, Haskel et al. (2007) find that a 1% increase in the share of MNCs in total employment raised the TFP of that industry by 0.05% in 1973-1992. Another study using panel data at firm-level (Fons-Rosen et al., 2013) analyses the impact of FDI in the TFP of manufacturing firms for a set of developed countries, including Portugal, and concludes that the impact is 0.007% in the 1999-2008 period. Finally, Santos & Khan (2018), using a dynamic panel data of manufacturing firms, for 1995-2007, estimate that 1% increase in the turnover of foreign firms raises the TFP in 0.42 percentage points.

Table 1. Impact of FDI on the TFP of manufacturing firms

FDI Measure		TFP increase (%)
Keller & Yeaple, 2009	Share of foreign-affiliates' employment	1.100
Pessoa, 2005*	Net annual inflows	0.019 -0.023
Haskel et al., 2007	Share of foreign-affiliates' employment	0.050
Fons Rosen et al., 2013*	Share of foreign capital of firms	0.008
Santos & Khan, 2018	Turnover	0.42

Notes- *Cross-section studies, including Portugal

FDI is one of the main potential sources of externalities to Portugal (EC, 2016). For example, in the period 1985-1995 there was a stronger contribution of TFP to economic growth, in part associated with FDI inflows financed by EU Structural Funds (Amador and Coimbra, 2007). Indeed, after 1988 there was a burst in FDI flows which increased the capital stock of about 4.2%, adding about 0.31% to GDP growth, per year (Mateus, 2006). Freitas and Mamede (2008) found that the share of foreign firms in 2005 was higher than average for products with "High" and "Very High" income content (56% and 43%, respectively); while Gonçalves and Martins (2016), using panel data for Portuguese manufacturing firms, for 2010-2014, found that exports prompted the TFP growth. Hence, the sustained growth of the economy will depend largely on the ability of economic agents to diversify financing sources, including by attracting FDI (Júlio et al., 2013). Hence, we assume that FDI inflows may be a channel of technological catching-up, and perform an analysis of correlation

between changes in FDI inward flows and in the manufacturing performance and in the aggregate productivity in order to provide a hint on the impact of FDI on the productivity and economic growth.[4] Bearing this in mind, we start by analysing the evolution of FDI inflows and the manufacturing performance. Subsequently we analyse the evolution of a set of indicators related to the innovation system in the Portuguese economy. Finally we scrutinize the sources of the technological gap and the goals of the Technological Plan, which aim to narrow the gap. Our analysis on the dynamics of Portuguese innovation systems draw from Schumpeterian literature on innovation and economic growth. The importance of innovation capability for the economic growth arise from the idea-based new growth models (Romer, 1990; Furman et al., 2002); whereas the role of absorptive capacity for imitation-based catching-up is highlighted in the technology-gap models (Abramovitz, 1986; Verspagen, 1991; Godinho et al., 2006; Fagerberg and Srholec, 2008). This exercise aims to gauge whether convergence is being triggered.

FDI inward flows. Portugal's accession to the EEC has indirectly contributed to the boost of inflows of foreign capital, which in 1986 accounted for 15% of GDP and 3.3% of total world FDI. Nevertheless, in 1986, FDI inflows represented only 4% of GDP and 0.5% of global FDI; whereas in 2016 it represented only 1% of GDP. After 2008, FDI flows have stabilized around 1% of GDP. However, in the period 2011-2015 FDI flows increased to 2% of GDP, due to privatizations carried out in the context of the Economic and Financial Assistance Programme (EFAP). As for the evolution of FDI stocks, it confirms the increasingly importance of foreign subsidiaries in Portugal. In 2016, FDI stocks represented 28% of GDP, 3.5 times more than in 1986.

Table 2. Flows and stocks of FDI (% GDP), Portugal (1986-2016)

Year	Flows	Stocks	Year	Flows	Stocks
1986	4	8	2002	1	19
1987	9	16	2003	3	22
1988	-2	12	2004	1	22
1989	7	18	2005	1	22
1990	2	17	2006	4	25
1991	2	17	2007	1	25
1992	1	17	2008	1	25
1993	1	18	2009	0	25
1994	1	17	2010	1	24
1995	0	16	2011	2	26
1996	1	16	2012	2	27
1997	1	16	2013	1	27
1998	2	16	2014	2	28
1999	1	16	2015	2	29
2000	3	18	2016	1	28
2001	3	19	**Average**	**2**	**20**

Source: author's calculations based in UNCTAD.

[4] Our analysis does not take into account technical transfer via FDI that occurs in Services sector.

Table 3 shows FDI inflows by EU Country. In 1993, Portugal was in the ninth position. However, the Country dropped to 15th position in 2013, being surpassed by Poland, Czech Republic and Hungary.

Table 3. FDI inflows (USD Million) to EU Countries (1986-2016)

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	4989	6648	6816	9208	10972	11511	12040	12106	14804	19720	19629	19522	23564	23471	30431	34329
Belgium	-521090	-181084	-294553	97389	-138324	-227052	-206200	-204039	-82242	-18504	-18233	-17279	-20766	-20362	-23492	-26347
Bulgaria	1032	-2633	904	108	112	168	210	250	355	445	554	1059	1597	2184	2704	2945
Cyprus	-1113	-1061	-999	-929	-802	-720	-613	-530	-454	-79	350	897	1242	2055	2910	3855
C.Repub	0	0	1291	1291	1363	1886	2889	3423	4547	7350	8572	9234	14375	17552	21644	27092
Denmark	4591	5629	5485	6905	9192	14712	14387	14618	18083	23801	22340	22268	35694	47643	73574	75438
Estonia	731	534	657	846	-603	14	96	258	473	674	825	1148	1822	2467	2645	3160
Finland	1680	2620	3040	3965	5132	4220	3689	4217	6714	8465	8797	9530	16455	18320	24273	24070
France	44465	49084	56287	69348	97814	110174	127883	135078	16344	19143	20015	19586	24621	24466	25977	29532
Germany	49277	64714	61526	84218	111231	123992	119965	116134	13915	16591	16251	15883	20677	23525	27161	27215
Greece	9071	10136	11632	13011	5681	6816	7960	8937	9918	10971	12029	13013	13084	15890	14113	13941
Hungary	10959	9786	9446	12942	570	2107	3424	5576	7087	11304	13282	17968	20733	23260	22870	27407
Ireland	36594	36917	37174	37367	37989	39351	40809	41887	42744	44187	46804	48940	62450	72815	12708	13405
Italy	25554	31353	36884	49391	59998	61576	49963	53949	60376	65350	74640	85468	10882	10863	12117	11343
Latvia	2298	722	1084	1778	343	145	176	221	436	615	936	1272	1558	1795	2084	2328
Lithuani	-607	-657	-193	-784	-26	97	107	137	321	352	700	1041	1625	2063	2334	2665
Luxemb	56320	107627	-91839	10848	-27533	-64537	-82537	-107994	5423	18504	18233	17279	20766	20362	23492	26347
Malta	308	327	368	420	465	542	582	651	416	562	844	858	1174	1872	2385	2551
Netherla	33354	43449	42546	52052	68731	72475	74440	74478	93409	11604	12654	12219	16447	19222	24373	28288
Poland	102732	39358	-1901	-37393	109	425	1370	2307	3789	7843	11463	14587	22461	26075	34227	41247
Portugal	4354	4870	5861	7670	10571	13020	14893	16427	17697	18982	21118	22392	30088	26910	32044	36023
Romania	0	0	0	0	0	44	122	215	402	821	1097	2417	4527	5671	6951	8339
Slovakia	17982	13295	-2394	189	282	363	463	642	897	1297	2046	2103	2920	3188	4746	5582
Slovenia	5804	3622	1636	1639	1643	1708	1819	1931	2048	2617	2730	2207	2777	2682	2893	2594
Spain	13436	22992	29578	41951	65916	79571	107840	100299	93148	10452	11976	10529	12605	12536	15634	17725
Sweden	6013	9234	9907	10920	12636	18085	14057	13127	22650	31043	34835	41454	51002	73301	93995	91942
U.Kingd	76283	109352	129654	15020	203905	208346	172986	179233	18958	19977	22864	25295	33738	38514	43863	50668

Source: UNCTAD

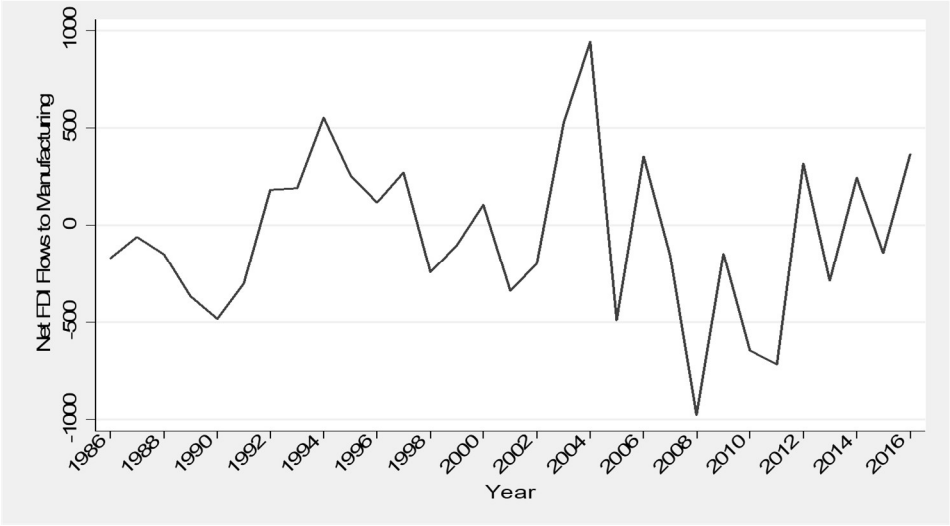
Table 3. FDI inflows (USD Million) to EU Countries (1986-2016) (cont.)

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Austria	43508	53844	62336	69454	84025	126895	145796	169124	160615	152768	164714	178825	176607	164785	107110
Belgium	229513	351499	466548	478183	633296	748110	854426	967601	873315	942817	512712	571776	476405	468710	421839
Bulgaria	4074	6371	10108	13851	22867	36508	27846	32829	31510	28179	29633	29855	29660	26375	17408
Cyprus	4912	6728	8594	8688	14577	18414	180043	186227	212576	182687	185190	177461	149440	138263	95401
C.Republic	38669	45287	57259	60662	79841	101074	113174	125827	128504	120569	136493	134085	121512	113057	83662
Denmark	82799	100191	116486	115953	135408	146632	103957	103197	96984	98406	98302	94482	97216	100858	73626
Estonia	4226	7002	10064	11290	12664	16594	15449	15841	15551	16350	18937	21202	19712	18914	14942
Finland	33987	50257	57376	54585	67991	85237	83534	85163	86698	89232	96641	88762	93901	92340	65561
France	385202	527624	641807	628075	771545	1026081	563005	648012	630710	698871	717328	796488	729147	772030	594463
Germany	297785	394513	512066	475996	578786	629711	789256	963511	955881	997727	1077019	1088690	1089569	1121289	818541
Greece	15561	22454	28482	29189	41288	52838	38119	42097	35026	29060	24765	25850	22534	17688	12205
Hungary	36224	48340	62585	61970	81586	97397	88054	98876	90845	85331	104017	108517	98885	92132	63571
Ireland	182897	222960	204819	163530	156593	187184	188290	250103	285575	290495	364607	392915	378202	435490	431135
Italy	130819	180891	220720	224079	294876	364839	327911	364427	328059	355127	375029	364959	346824	335335	224674
Latvia	2751	3277	4529	4929	7476	10493	11309	11629	10935	12111	13534	15956	14668	14549	9893
Lithuania	3981	4960	6389	8211	10996	14679	12949	13216	13271	14266	15966	17542	15619	14440	9242
Luxembourg	34972	41730	49733	43721	66658	30176	125128	172217	172257	225725	167222	91396	180434	205029	135319
Malta	2413	3281	4018	4315	6498	7457	117077	125193	129770	146146	165530	184584	173838	163522	112830
Netherlands	349969	426611	477219	451078	502226	673430	647414	646292	588078	610677	628187	770976	715706	707043	445437
Poland	48320	57877	86623	90711	124530	142110	148417	167399	187602	164424	198953	229167	205581	213071	144888
Portugal	44637	60585	66970	63339	87959	114192	105511	118299	114994	103761	114573	124623	118918	114220	62821
Romania	7846	12202	20486	25817	45452	60921	64759	69883	68093	69513	76329	82688	73086	69112	46996
Slovakia	8530	14576	20910	23656	38335	40702	50416	52537	50328	51980	55124	58021	52488	48163	34196
Slovenia	4112	6308	7590	7259	8924	10350	11966	11277	10667	11490	12203	12269	12299	11847	7700
Spain	257106	339652	395984	370943	441039	537455	588901	632246	628341	628950	644677	638982	591709	533306	383980
Sweden	119368	158884	196290	171768	226385	254459	278802	332150	347163	349058	373444	386105	311786	281876	205770
U.Kingdom	523320	606158	701913	850963	1133437	1347688	901515	1015805	1057188	1145720	1428059	1489940	1744230	1457408	932741

Source: UNCTAD

Indeed, with the acceleration of globalization that started in the new millennium, FDI flows targeting the Portuguese manufacturing sector became more volatile.

Figure 1. Net FDI flows to Manufacturing (USD million), Portugal (1986-2016)

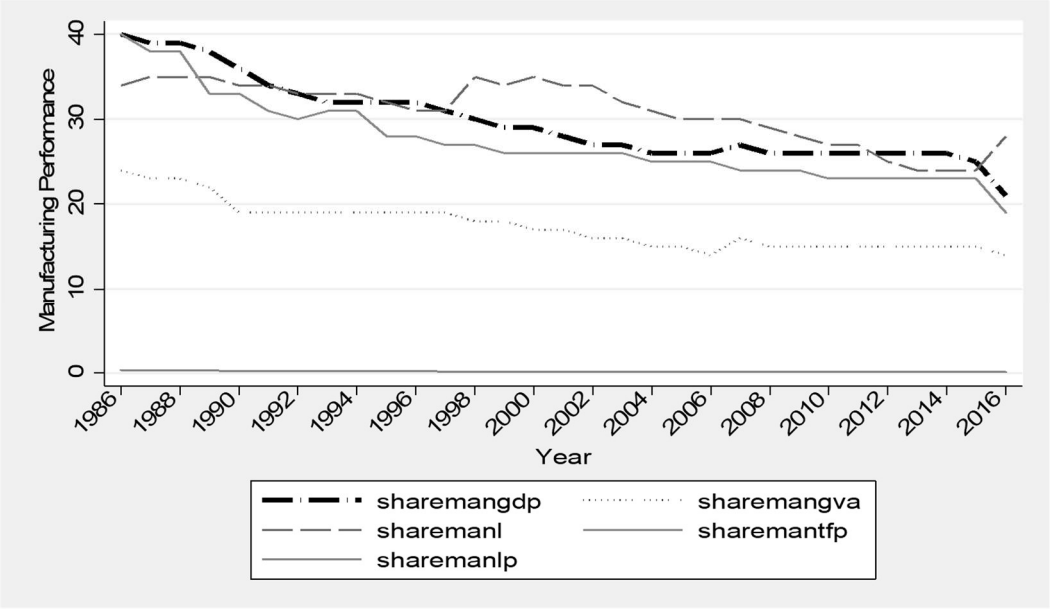


Source: Author's calculations based in OECD Stat.

Bearing this in mind, we analyse the joint evolution of FDI flows to the manufacturing sector and the factor contribution (%) to GVA increase in the manufacturing sector from 1986 to 2016, in search for a hint regarding the role of FDI to TFP increase in the manufacturing sector.

FDI and the Manufacturing performance. In what follows we analyse, on the one hand, the evolution of net FDI flows targeting the manufacturing sector in 1986-2016, and its performance regarding output, value added and productivity; and, on the other hand, the contribution of the subsidiaries in the manufacturing sector in Portugal, by technological groups, concerning high technology exports and growth accounting, in the same period. Through the joint analysis of Figures 2 and 3 on the evolution of net FDI flows targeting the manufacturing sector and the performance of this sector, we can observe a tendency in which the peaks of 1994, 2004, 2006 and 2012 correspond to years in which the contribution of manufacturing to employment was higher than the contributions to output, value added and productivity (or equal to the contribution to GDP in the years of 1994 and 2012). In the evolution of manufacturing sector from 1986 to 2016, we distinguish two phases. The first, from 1986 to 2004, is characterized by a decline in the share of output, TFP and GVA. After 2004, the 3 aggregates seem to have stabilized below 30%. In 2016, it is observed a small decline.

Figure 2. Manufacturing Performance (%), Portugal (1986-2016)



Notes: Labour productivity is the real GVA per hour worked Shareman denotes the share of manufacturing sector, gdp is gross domestic product, l is labour, lp is labour productivity, gva is gross value added and tfp is total factor productivity. Source: Total Economy Database. Groningen Growth and Development Centre.

In 1990 and 2013, the net flows to manufacturing were negative (i.e., foreign divestitures were higher than investments) yet we found that the contribution of manufacturing to the output was higher than the contribution to employment. This evolution cannot be dissociated from further European integration, especially with the adhesion to the euro and the privatization process. The appreciation of the national currency (escudo) before the adhesion and the setting of an excessively high irrevocable conversion rate between the escudo and the euro had a strong punitive effect, in a context where Portugal could no longer offset the losses in competitiveness via the devaluation of its currency (Mateus, 2015). Moreover, privatization heightened the deindustrialisation, as shown, for example, with the liquidation of heavy metallomechanics. These difficulties, combined with a sharp drop in interest rates tended to guide investment to the so-called non-tradable goods, housing, public works and consumption (Marques and Lynce, 2011).

We investigated the correlation between FDI flows targeting the manufacturing sector, and the manufacturing performance regarding output, employment, and labour productivity, as well as convergence (using the gap in labour productivity and the TFP vis-à-vis the EU-28 average), respectively. Regarding the manufacturing output, there is a positive but weak correlation in the current period. This correlation is negative but weak for the manufacturing output with one and two period lags.

Regarding employment, there is a positive but weak correlation in the current and lagged period, although the value of correlation is higher for employment with two-year lag. This may imply that it takes two years before the foreign projects begin to exert positive benefits regarding employment in the manufacturing sector.

Concerning labour productivity, there is a negative and strong correlation in the current period. This negative correlation is weak regarding labour productivity in lagged periods. As for convergence of productivity with the EU-28 average, there is a positive but weak

correlation with the gap of labour productivity. Because the gap is constructed as the ratio between labour productivity of EU28 countries and labour productivity in Portugal, a positive correlation implies that the larger the flows the larger the gap regarding labour productivity. Hence, in spite of FDI flows have a positive relation with employment in manufacturing, on the whole economy it appears that foreign firms contribute to deteriorate the labour productivity of domestic firms. One explanation is that may be the case that FDI causes a loss of market share to the domestic firms, via competition and these firms are forced to operate in an sub-optimum scale. As a result the labour productivity of domestic firms may decrease. However, there is a negative but weak correlation between FDI flows targeting the manufacturing sector and the gap of TFP (current period). In the same line of reasoning, because correlation is negative, it appears that FDI flows to manufacturing industries might help to close the gap regarding TFP. The EU countries have been experiencing a relative under-performance regarding productivity, when compared to the US. It has been highlighted that the causes were the slower adoption of new technologies compared to the US (Jorgenson and Stiroh 2000; O'Mahony and Vecchi 2005; Venturini 2009), and the insufficient level of skills and organizational changes. Indeed, investments in these two later assets may affect countries' absorptive capacity, i.e. their ability to take advantage of the international diffusion of technology (Foster-McGregor et al., 2013). Since the bulk of technological innovations is concentrated in few countries, the economies that are far from the technological frontier need to improve the absorptive capacity of their industries as a mean to enhance productivity growth. The evolution of labour productivity in the Portuguese manufacturing sector, measured by GVA per hour worked shows that the Portuguese manufacturing sector follows the trend of the EU-28 average, especially since the financial crisis in 2008. Over the period, the values are near zero. Table 4 shows the Growth Accounting analysis (GVA growth and contributions in volume).

Table 4. Share (%) of MNCs in Total Economy, Portugal (1986-2016)

Year	No.Firms	Employment	Value Added	Year	No.Firms	Employment	Value Added
1986	0.5	7.2	20.3	2002	0.1	2.7	8.1
1987	0.3	4.6	15.2	2003	0.2	4.5	17.6
1988	0.3	5.2	13.6	2004	0.2	4.4	14.5
1989	0.4	5.8	13.7	2005	0.3	5.1	16.4
1990	0.2	5.0	12.5	2006	0.4	5.4	16.5
1991	0.5	8.5	19.9	2007	0.4	5.7	17.0
1992	0.3	5.7	15.6	2008	0.4	6.9	17.5
1993	0.4	5.8	18.7	2009	0.4	6.9	17.6
1994	0.4	8.2	19.8	2010	0.4	7.2	18.4
1995	0.3	5.8	15.7	2011	0.5	7.3	18.7
1996	0.3	4.7	16.1	2012	0.5	7.2	18.6
1997	0.2	4.5	12.6	2013	0.4	7.5	18.8
1998	0.2	4.3	14.4	2014	0.3	5.1	11.8
1999	0.2	3.6	7.8	2015	0.3	4.6	10.6
2000	0.2	3.6	8.5	2016	0.1	2.7	8.1
2001	0.1	2.5	8.5	**Average**	**0.3**	**5.4**	**14.9**

Source- Author's calculations based in UNCTAD

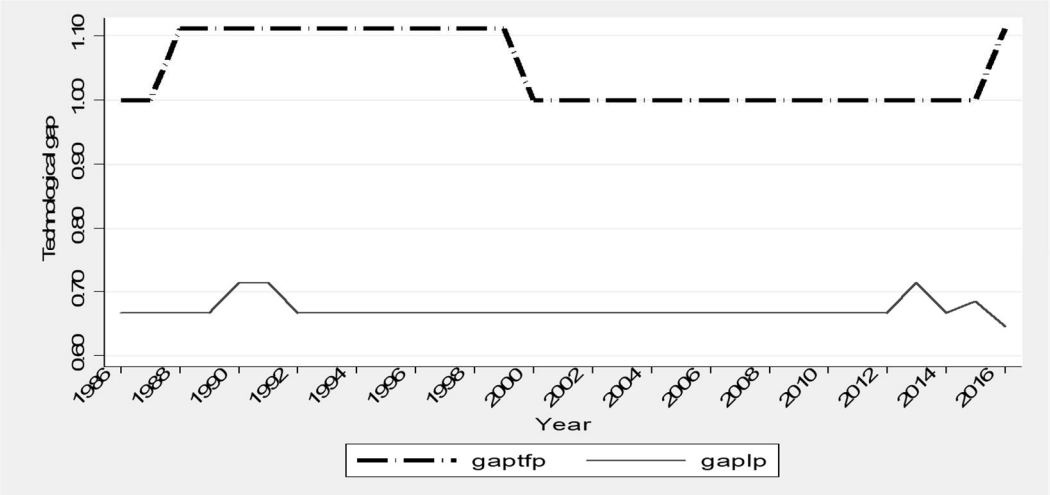
The contributions for GVA derive from labour (low, medium and high-skilled labour); capital (ICT and non-ICT) and the TFP.[5] The values for 1996-2005 are obtained from EUKlems database (version of 2009 for Portugal) and the values for the remaining years were obtained by multiple imputation in Stata 13.0. The joint analysis of Table 5 and Figure 3 shows that, in the years that recorded peaks of net flows, capital contributions to manufacturing GVA were positive and in 2004, where there is an absolute maximum in regarding net flows, the contribution of TFP was also positive (0.1).[6] It should be noted that in the cited years of maximum and minimum flows, the contribution of labour to the manufacturing GVA was negative.

Table 5. Growth Accounting in Manufacturing sector, Portugal (1986-2016)

Year	Labour	Capital	TFP	Year	Labour	Capital	TFP
1986	-0,5	2,1	0,4	2002	-0,5	1,2	-1,7
1987	0,2	1,0	3,7	2003	-1,0	0,5	-0,5
1988	-1,4	-0,5	7,7	2004	-0,4	0,5	0,1
1989	-0,8	2,1	6,9	2005	0,2	0,5	-2,4
1990	-1,9	2,2	4,4	2006	-0,6	1,0	-1,8
1991	-3,3	1,7	7,9	2007	1,1	1,0	-2,0
1992	-0,8	1,0	-1,9	2008	-0,1	-0,2	-1,6
1993	-0,8	1,7	-2,7	2009	0,1	1,3	-3,9
1994	-0,6	0,6	-5,5	2010	0,2	0,6	-1,7
1995	-1,1	1,3	4,0	2011	2,9	0,3	-5,8
1996	0,8	0,5	6,1	2012	0,4	0,5	-3,4
1997	-2,4	1,3	6,8	2013	-0,9	1,2	-0,5
1998	-1,5	1,4	2,7	2014	1,7	0,8	-4,9
1999	1,5	1,9	-3,8	2015	-2,0	-0,6	7,6
2000	0,2	2,3	-0,2	2016	-0,4	0,3	3,3
2001	-1,5	2,2	0,5	**Average**	**-0,4**	**1,0**	**0,6**

Note- values for 1986-1995 and 2006-2016 obtained by Multiple Imputation in Stata 13.0
Source: EUKlems database

Figure 3. Productivity gap between the average EU-28 Countries and Portugal (1986-2016)



Notes: Lp is calculated as GDP per hour worked, USD, constant prices, 2010 PPPs and TFP is TFP level at current PPPs (USA=1). Source: Author's calculations based on OECD.Stat and Penn World Table, version 9.0

[5] This distintion in capital aims to better gauge the impact of information and communication technologies (ICT) on growth.
[6] The contribution is the factor share times the factor growth rate.

Concerning the closing of the technological gap, in 1994, the TFP in Portugal was higher than that of the EU-28 average, but in the remaining years, when there was a maximum in net FDI flows, the TFP level was equal to the UE-28 average. As for the labour productivity gap, it curiously narrowed both in 1990 and 2013 when net FDI flows were negative. This may imply that competition from foreign firms in the host economy caused a loss of domestic firms' market shares. As they are compelled to operate in a sub-optimum scale there is a subsequent fall in their labour productivity.

Tables 6 and 7 concern the contribution of foreign firms in the manufacturing. On average, in the last 30 years of European integration, the subsidiaries represented only 0.3% of the firms but contributed to 15% of value added and 33% of exports, of which (at least) 14% concerns high-tech products (see Table 11). Therefore, in general, FDI in Portugal has contributed significantly to the structural change of exports, towards technology-intensive activities. Thus, the loss of FDI attractiveness seem to have a negative impact on the export performance of the country.

Table 6. Share (%) of MNCs exports in Total, Portugal (1986-2016)

Year	MNCs exports in Manufacturing	% Total	Year	MNCs exports in Manufacturing	% Total
1986	1199	22	2002	6875	28
1987	1415	22	2003	6922	24
1988	1875	24	2004	9157	30
1989	2062	20	2005	12849	41
1990	4667	40	2006	8906	25
1991	3703	31	2007	17905	47
1992	5565	45	2008	9746	25
1993	1901	15	2009	13826	44
1994	2898	18	2010	16387	44
1995	3667	21	2011	17514	41
1996	6792	35	2012	20369	45
1997	6440	30	2013	11907	25
1998	4236	19	2014	25436	53
1999	5565	24	2015	17285	35
2000	11006	48	2016	25833	49
2001	10370	45	**Average**		**33**

Values in USD Million. Source: Author's calculations based in World Bank (World Development Indicators) and Eurostat.

Table 7. Contribution (%) of foreign firms to high-tech exports, Portugal (1986-2016)

Year	MNCs exports in science based industries (% Manufacturing)	Year	MNCs exports in science based industries (% Manufacturing)
1986	11	2002	5
1987	10	2003	7
1988	8	2004	9
1989	7	2005	12
1990	28	2006	13
1991	16	2007	17
1992	34	2008	8
1993	8	2009	20
1994	8	2010	17
1995	5	2011	16
1996	23	2012	18
1997	14	2013	11
1998	7	2014	17
1999	15	2015	12
2000	19	2016	16
2001	14	**Average**	**14**

Source: Author's calculations based in World bank Database (World Development Indicators), OECD Stat and UNCTAD (2013, p.30).

Along the lines of the lower dynamism in promoting FDI, Portugal is the MS where foreign subsidiaries have less weight in employment and wealth creation. Tables 8a and 8b show the foreign firms' performance regarding gross operating surplus and employment.

Table 8a. MNCs' Performance (Gross Operating Surplus) by industry, Portugal (1986-2016)

Industry	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Food products	203	217	190	204	167	205	212	194	156	173	196	199	193	178	198
Beverages	66	49	83	35	35	90	46	47	71	73	76	66	43	69	43
Textiles	14	37	36	11	22	28	22	20	23	14	29	13	12	10	34
Wearing apparel	2	6	6	6	4	5	5	7	4	3	5	5	3	5	3
Leather products	14	19	28	22	33	11	16	14	13	24	44	10	28	16	13
Wood	89	102	115	55	55	114	25	101	75	25	45	22	94	33	95
Paper products	51	66	71	58	67	53	58	49	52	65	59	71	48	49	62
Printing	30	37	15	8	32	56	2	66	6	32	50	32	15	63	31
Chemicals	52	181	83	157	81	147	72	102	173	195	156	186	147	67	153
Pharmaceuticals	122	85	123	114	101	98	110	122	124	105	124	115	106	111	103
Rubber and plastics	240	334	196	305	242	250	283	229	217	207	283	273	251	315	219
Other non-metallic minerals	109	204	194	142	214	109	163	208	158	202	126	204	152	142	211
Basic metals	44	47	50	37	36	55	65	54	38	55	52	66	60	39	49
Fabricated metal products	52	66	68	60	53	59	50	70	70	64	39	56	68	68	66
Computer & electronics	52	53	33	61	49	62	65	76	52	49	73	58	55	68	38
Electrical equipment	90	87	102	58	54	96	98	50	64	70	83	99	120	62	57
Machinery& Equipment	69	102	67	53	65	102	73	104	63	77	58	47	63	105	80
Motor vehicles	362	300	252	317	183	168	273	245	330	245	175	283	322	239	366
Other transport equipment	76	56	58	112	18	14	26	83	22	101	73	25	11	96	150
Furniture	11	41	11	44	29	6	20	29	14	8	38	7	43	40	19
Other manufacturing	47	51	48	49	47	46	45	51	50	51	41	41	40	52	44
Repair and installation	28	24	23	29	28	24	23	25	26	22	22	30	21	26	29

Source: EUROSTAT, Foreign control of enterprises by economic activity

Table 8a. MNCs' Performance (Gross Operating Surplus) by industry, Portugal (1986-2016) (cont.)

Industry	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Food products	162	155	192	194	155	194	204	222	216	202	158	150	141	145	157	169
Beverages	33	95	43	92	94	62	57	97	104	97	91	63	69	88	33	73
Textiles	37	14	24	25	27	9	33	18	6	30	32	25	38	6	24	19
Wearing apparel	3	3	3	4	4	6	7	6	1	6	4	-2	5	7	5	5
Leather products	16	47	17	13	17	18	15	10	8	21	9	13	12	22	41	19
Wood	44	19	37	22	22	17	10	24	13	18	18	19	18	19	10	17
Paper products	72	60	49	60	59	61	56	56	61	76	61	58	64	72	75	65
Printing	37	11	39	12	46	4	4	6	4	2	1	1	0	2	11	18
Chemicals	157	126	159	164	129	110	128	196	140	188	179	51	70	103	159	155
Pharmaceuticals	108	88	86	116	115	85	106	106	124	89	84	94	88	104	107	115
Rubber and plastics	234	324	235	292	279	216	235	165	192	240	272	301	337	340	345	267
Other non-metallic minerals	156	103	182	160	214	150	209	135	103	132	114	92	102	214	106	191
Basic metals	61	61	48	36	41	69	54	35	-24	39	14	10	23	51	64	35
Fabricated metal products	43	55	43	58	49	64	49	69	64	71	38	40	47	62	69	52
Computer & electronics	60	68	38	34	61	59	34	57	54	84	81	62	64	64	40	38
Electrical equipment	68	108	71	121	64	59	106	173	157	165	143	97	106	103	104	108
Machinery& Equipment	92	50	87	65	106	71	42	112	36	63	54	71	56	66	72	98
Motor vehicles	143	221	328	191	303	132	192	284	245	362	394	329	328	366	332	139
Other transport equipment	85	39	114	157	124	2	71	102	149	10	-29	-99	-10	-12	99	155
Furniture	38	8	38	6	12	38	25	-6	2	9	6	4	24	27	38	44
Other manufacturing	48	48	49	40	43	40	42	35	39	41	52	45	46	44	50	51
Repair and installation	21	25	24	29	30	26	22	29	31	24	22	29	24	21	22	24

Table 8b. MNCs' Performance (Number of Employees) by industry, Portugal (1986-2016)

Industry	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Food products	4292	4410	6676	3369	5096	3317	5887	3196	2164	2742	4079	4322	8156	10903	3936
Beverages	6768	4597	1201	4149	1355	3408	3094	2456	3195	2439	3713	4016	2884	2704	1243
Textiles	5878	4776	3804	3488	4986	3569	6331	6886	5862	5412	3193	5574	7175	3382	2405
Wearing apparel	3528	3840	6602	2483	5408	4921	1517	591	2050	5756	2450	1619	475	5914	2390
Leather products	1495	8001	6608	8039	2736	4217	6469	7716	5737	4715	5994	6752	6832	5917	6011
Wood	1221	2434	6359	8064	3916	2440	3611	3398	4972	4686	5100	3544	4005	7692	6435
Paper products	4697	5733	2441	2234	3772	3606	3500	2964	4693	3976	7429	6434	7724	3658	2169
Printing	364	738	507	490	694	627	514	371	160	389	740	430	466	661	773
Chemicals	3133	8315	6367	4063	6143	7262	5620	4283	2705	645	2196	6682	2049	4874	4669
Pharmaceuticals	5664	3771	2828	3822	4432	2595	4139	3082	3120	2166	4372	7437	8300	9196	3310
Rubber and plastics	6219	4375	4729	5884	5205	3212	6744	6693	5841	5392	4624	2316	6595	5389	4056
Other non-metallic minerals	5296	5174	1800	1384	1705	1466	1753	5954	7657	2138	7310	8123	6190	3474	1790
Basic metals	1745	1546	7842	2125	3196	6565	4939	2023	3982	2708	4420	7103	1618	1950	5782
Fabricated metal products	9645	7270	6039	7843	4897	7610	7491	9938	8028	6413	5589	4007	4089	5031	6595
Computer & electronics	8021	8074	4779	8203	1757	5212	1543	3326	2760	3252	2262	7465	8184	6625	5704
Electrical equipment	4740	9474	8140	4484	2301	2452	3341	2733	3094	5220	8990	10210	6097	8444	5601
Machinery& Equipment	3563	3044	4794	4722	2392	7324	2050	1745	4473	4281	4872	4971	6185	7510	5684
Motor vehicles	10628	14484	13096	12780	13481	13114	9130	13874	17469	13931	16650	17240	16620	11786	17755
Other transport equipment	5517	7300	5173	7527	7092	7365	7327	4552	4697	3139	3916	5505	8658	5895	5655
Furniture	2027	4558	6612	3517	2933	1033	2276	2092	1556	2996	6941	8045	4314	5067	4287
Other manufacturing	5458	4252	3525	3535	2930	4386	3643	5170	4610	5713	6087	3282	1645	10206	2682
Repair and installation	4554	3174	6889	7009	5143	3159	4119	3770	5106	4531	5557	5601	3769	2082	2881

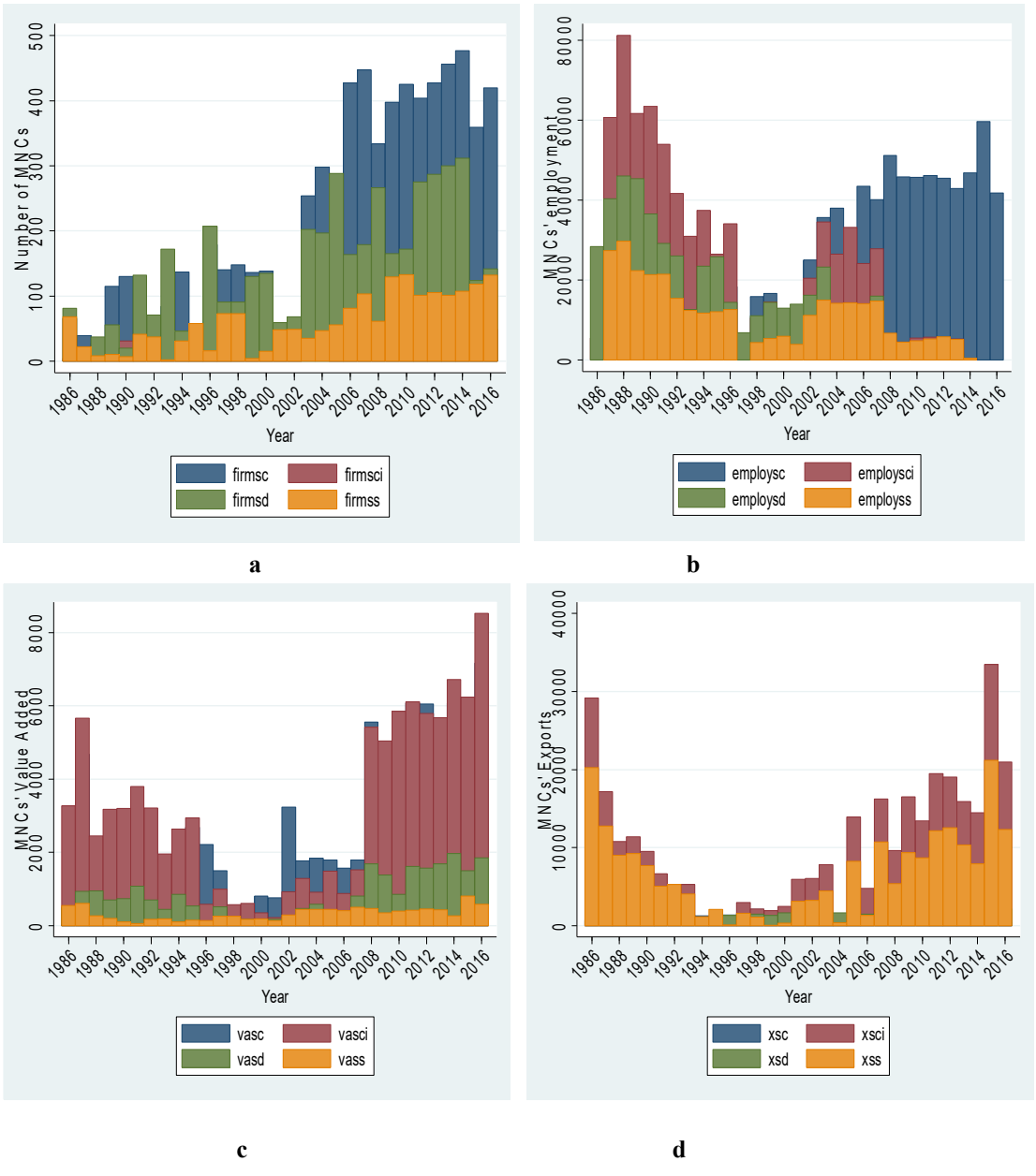
Table 8b. MNCs' Performance (Number of Employees) by industry, Portugal (1986-2016) (cont.)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Food products	3932	4242	3076	7437	8680	6131	8795	9427	7124	8873	8999	8593	8394	9592	8718	5967
Beverages	2753	3878	2772	1270	2364	3453	3154	2684	2590	2395	2380	2302	1991	2265	3595	1260
Textiles	3810	4286	3921	1209	2098	7715	6519	4014	3592	3363	3197	2694	2772	2964	4030	3659
Wearing apparel	3684	4310	5868	3664	4927	5906	3880	4692	3737	3638	3534	3396	3410	3375	4906	4100
Leather products	4262	4806	3002	4468	6831	4327	6809	4963	4601	6759	3681	4102	4746	5262	5678	2270
Wood	5550	2332	3947	4351	4842	3618	2233	1369	1250	1241	1267	1219	1146	1405	1253	1731
Paper products	2797	2628	2743	2519	1040	3756	1320	2275	2206	2168	2064	2036	2180	2360	2763	1069
Printing	563	981	963	503	732	492	415	477	454	392	386	379	271	292	146	264
Chemicals	3801	7241	5754	4351	5711	6774	5237	5488	5094	5169	5092	4897	4556	4597	5049	4536
Pharmaceuticals	7050	4458	2876	2506	4651	3287	2158	2157	2432	2401	2416	2518	2339	2442	2940	2527
Rubber and plastics	6099	7548	5604	6543	6493	8424	8415	6055	5556	5751	6163	6179	6073	6437	3004	5221
Other non-metallic minerals	3734	3683	4192	5276	7446	6884	5863	6277	5811	5611	5448	5228	5329	6413	5588	7095
Basic metals	6599	7446	3448	3193	4307	4046	2498	2562	2271	2251	2307	2067	2154	2622	2313	1162
Fabricated metal products	7599	6617	8141	3441	6037	4575	3675	4698	4410	4420	4353	4248	4743	4988	2184	4410
Computer & electronics	4462	6953	6644	6000	5161	3039	3953	4763	5828	5978	5650	5502	5080	5288	6533	5075
Electrical equipment	4292	5594	3901	4293	9330	7949	6448	9149	8947	9145	9496	9444	9573	9430	8833	7025
Machinery& Equipment	7411	3073	4028	3477	6638	5002	6735	5902	3693	4080	4273	4909	4233	4458	7265	6589
Motor vehicles	11095	11380	12310	15769	11398	15029	22352	22874	19999	18831	19108	19163	19315	19591	18828	14371
Other transport equipment	4389	5589	9110	3312	7513	6053	5011	3620	6207	1492	3584	2643	1586	1610	1859	4483
Furniture	3121	2123	1035	2909	1360	2355	2407	1872	1502	2098	2110	2301	2247	2318	2229	2910
Other manufacturing	3986	2324	1814	3185	7246	6136	2860	2368	2531	2513	2717	2770	2737	2611	1769	1865
Repair and installation	6408	4712	7339	5897	3340	2036	2481	2676	2758	2743	2867	2746	2651	2747	3362	2910

Source: EUROSTAT, Foreign control of enterprises by economic activity .

Regarding the gross operating surplus, the importance of subsidiaries in 1986-2016 was greater in the motor vehicles industry, food products, rubber and plastics and chemicals, i.e., in scale intensive and science-based industries. The role of subsidiaries in creating employment was more relevant in the motor vehicles industry, food products and electrical equipment, rubber and plastics and other non-metallic minerals, again in scale intensive and science-based industries.

Figure 4. MNCs by technological groups, Portugal (1986-2016)



Notes: Panel a- Number of firms (*firm*), panel b-Number of employees (*employ*), panel c- Value Added (*va*) and panel d- Exports (*x*). Sc denotes scale intensive industries; sci denotes science based industries; sd denotes supplier dominated industries and ss denotes specialized suppliers industries. Nominal values are in EUR Million. Source: Author's calculations based in EUROSTAT- Foreign control of enterprises by economic activity (Portugal).

Scale intensive industries are major contributors to the number of firms and employment, with science-based industries being the group with fewer firms and the specialized

suppliers contributing less to employment (see Figure 4). The presence of foreign firms can trigger knowledge externalities to the manufacturing domestic firms, which are main vehicles of technological change due to their upstream and downstream linkages. Identifying the drivers of productive efficiency is crucial to understand the sources of the productivity gap. Thus, we will examine whether there was technological change in the Portuguese economy to assess the efficacy of public policies and instruments (financial incentives provided by the Structural Funds) in Portugal.

Technological Change. We analyse a dataset of indicators of technological change, in order to establish the correlation between its changes and the evolution of FDI inward flows. If the correlation is positive, it may indicate a positive impact of FDI on innovation and/or the absorptive capacity in the Portuguese economy. The construction of the dataset employs the method of multiple imputation.[7] Specifically, we construct a dataset that contains no missing values. The dataset comprises 8 indicators measuring two important country-specific dimensions: innovation and technological capabilities, and absorptive capacity (see Table A1 in appendix A). The dataset that is obtained by estimating the missing values in the original data sources (Pordata and Ministry of Science) provides comprehensive statistical information for the period 1986-2016 (for a total of 31 observations). Our empirical analysis of this dataset shows its reliability and points out its usefulness for future time series studies of the Portuguese national innovation system. Historically, the first generation of innovation indicators focus on inputs such as R&D investment, education expenditure, capital expenditure, research personnel, university graduates, technological intensity, and the like. The second generation added input indicators by accounting for the intermediate outputs such as patents, scientific publications and new products and processes. The third generation draw attention to indicators and indexes based on surveys. Although some of the information collected is now qualitative, there is no question that a fourth generation of innovation indicators is required for sound policy implementation. Such indicators would account for Knowledge, Networks and Conditions for innovation. A multi-layered concept like knowledge, however, can only be captured by composite indicators that may include composite knowledge investment and performance indicators; networks should include contractual agreements (partnerships, intellectual property licensing) and informal collaboration and knowledge exchange (working relationships of individuals across organizations); finally, Conditions for innovation refers to systemic innovation measures that capture the context in which organizations form and match expectations and capabilities to innovate. Yet, so far, these 4th generation indicators remain ad hoc and are of limited analytical value. They can be improved only through a coordinated and internationally effort. Table 9 shows the most used innovation and absorptive capacity indicators. A major criticism of most absorptive capacity measures is that they were developed for large firms and are therefore totally inadequate for small firms. Since small firms do not always have a specific R&D department, it can be difficult to measure the resources allocated to research activities. Furthermore, as many small firms consider the patent process to be too expensive and time-consuming, the indicator of Patent registrations is also frequently inapplicable. Thus, the absence of a R&D department or a patent registration policy does not mean that

[7] Multiple imputation is an iterative method to address missing data and fittingly reproduce the variance/covariance matrix one would have observed. In this process, the distribution of the observed data is used to estimate multiple values that reflect the uncertainty around the true value. These values are then used in an OLS model, and the results combined.

a firm does not acquire knowledge. Hence, the suitability and validity of proxy measures for absorptive capacity are highly empirically questionable.

Table 9. Most common innovation and absorptive capacity indicators

Measure	Studies	Main advantages	Main drawbacks
Innovation indicators			
Process innovations	West et al. (2003)	Reflects improvements in processes and methods	Focus solely on processes
Ratio of sales of new products to total sales	Czarnitzki & Kraft (2004)	Indicator of market success	Since it is a very broad indicator, it may reflect the impact of other factors besides innovation
Total R&D spending; Number of employees in R&D	García-Morales et al. (2008)	Easy to obtain	Does not provide indication of innovation efficiency
Patents or patent applications	Jung et al. (2008)	Measures technological progress	Nearly 95% of patents lack any market relevance and 99% fail to bring any profit to the firm (Stevens & Burley, 1997)
New products or product improvements; New markets entered	Elenkov & Manev (2009)	Indicator of radical innovation; reflects concrete implementation	Only about 60% of new products succeed
Ratio of sales of new products to R&D expenditures	Gumusluoglu & Ilsev (2009)	Indicator of R&D efficiency	Difficulty to establish a valid baseline
Patent citations	Makri & Scandura (2010)	Measures importance of patents	Patents may be self-cited
R&D expenditures (% GDP); number of patent applications by residents; number of scientific publications.	Castelacci and Natera (2013)	Easy to obtain, measures technological progress	Does not indicate innovation efficiency; patents usually lack market relevance; publications may be self-cited

Source: adaptation based on Duchek (2013), Flatten et al. (2011), Jimenez-Barrionuevo et al. (2011) and Murovec and Prodan (2009).

Table 9. Most common innovation and absorptive capacity indicators (cont.)

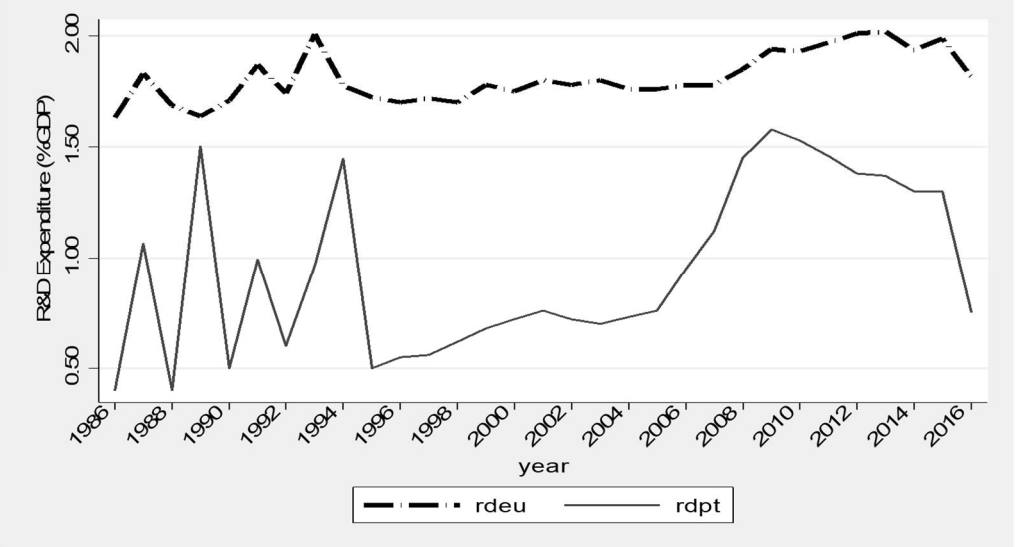
Absorptive Capacity indicators			
Total Number of Publications based on dollars spent on research annually	Cockburn, Henderson [1998]	Generally accepted measure that can be used for international comparisons. Data on patents are easily and internationally available.	Purely quantitative measure. Data are not readily available. International and sectoral differences in patenting behaviours. There are differences in patenting between large and small firms. Same weight is given to very important and less important patents.
Number of Patents	Ahuja, Katila [2001]; George et al. [2001]		
Participation in life-long learning; Employment in medium/high-tech industries	Kutlača (2008)	Employment in medium/high-tech industries is easy to obtain	Participation in life-long learning is difficult to obtain, due to incipient tracking down system. Systematized indicator for European Countries is recent. Employment in medium/high-tech industries have a limited explanatory power considering that there are several other sources of absorptive capacity.
GDP per capita, purchasing power parity; International Trade (Imports+ Exports % of GDP); Number of Total Graduates; Electric Power Consumption; Gini Index	Castelacci and Natera (2011)	Generally accepted measure that can be used for international comparisons. Data are easily and internationally available.	GDP per capita is an average measure.

Source: adaptation based on Duchek (2013), Flatten et al. (2011), Jimenez-Barrionuevo et al. (2011) and Murovec and Prodan (2009).

After Castellacci and Natera (2013) we measure the dimension of the process of technological change, i.e. the dynamics of the Portuguese innovation system, through a set of indicators of innovative capability and absorptive capacity. Regarding innovative capability, the more domestic firms acquire and absorb new knowledge, the more innovation and competitive advantages they will obtain (Kim, 1998). Since absorptive capacity is a by-product of R&D (Cohen and Levinthal, 1990), innovative input is used as a measure of innovative capability, proxied by R&D expenditures as a percentage of GDP. The assimilation of new knowledge that may lead to the development of new products and processes; and/or the ability to reform the organizational routines, to apply knowledge can be measured by technological and scientific output, respectively proxied by the number of patent applications by residents and the number of scientific publications. As far as absorptive capacity is concerned, GDP per capita controls for the purchasing power of the domestic market. The income and the development level are likely to hustle output growth (Balasubramanyam et al., 1999) and are measured by GDP per capita, purchasing power parity. Indeed, assuming that the higher the GDP per capita, the greater the level of development, and the more education infrastructures. Cœteris paribus, the existence of universities and other educational institutions increases the absorptive capacity. Moreover, many empirical studies analyse the relationship between absorptive capacity and international technology transfer. These studies use international trade, as a measure of foreign technology, that can be proxied by Imports+ Exports as a percentage of GDP. Higher education increases the ability to utilize new knowledge. Thus, higher absorptive capacity will lead to high performance (Conlin, 2006). Accordingly, we use an indicator of human capital measured as the total number of graduates. Furthermore, the World bank (World Development Indicators Database) uses infrastructures as an indicator of penetration of older technologies. First rate infrastructures devoid of a sufficiently qualified labour force will be useless and vice versa (Abramovitz, 1989). Infraestructures can be measured by the electric power consumption.[8] Because the acess to education requires income, income inequality reveals primarily as a social problem of unequal access to education, arising from inadequate access to resources (Ball 2004; Teese and Polesel, 2003). The income distribution can be associated with social cohesion and economic inequality (Alonso and Garcimartín 2011) and can be measured by the Gini Index. Starting with innovation, we analyse the R&D expenditure as a percentage of GDP in 1996-2016 (Figure 5).

[8] Archibugi and Coco (2004) suggest another two indicators: internet and telephone penetration. According to the authors, Internet is a key infrastructure for business and as a mean of access to knowledge; while telephone mainlines connect customers' equipment to the public switched telephone network allowing communications and exchange of knowledge. However we could not get values for internet prior to 2001. As regards telephone subscribers, we obtained data from world bank development indicators but it was not clear how many countries were included in the data, since the period 1986-2016 includes several EU enlargments. Hence we could not calculate the average value.

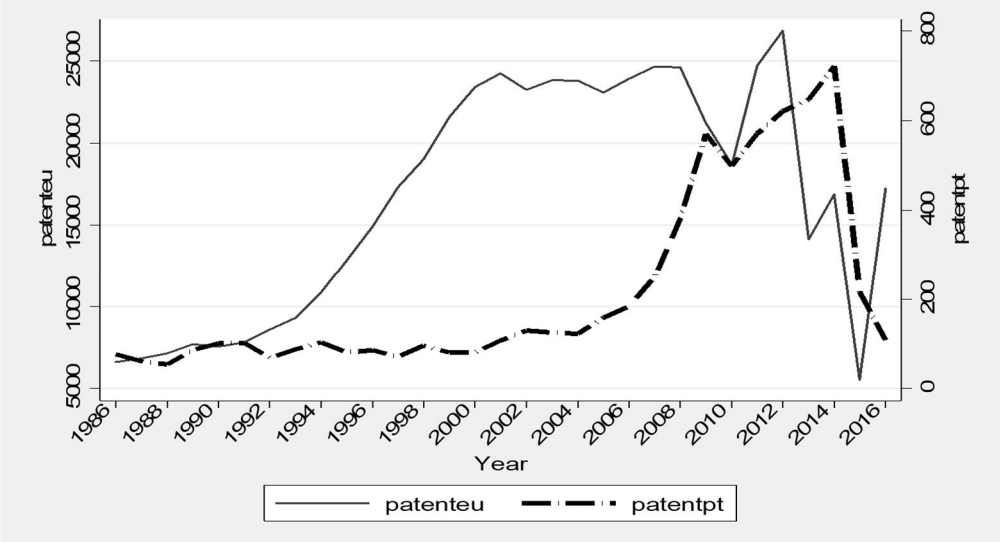
Figure 5. R&D Expenditure (% GDP), average EU-28 and Portugal (1986-2016)



Notes: rd denotes Research & Development expenditure; eu denotes European Union and pt denotes Portugal. Source: Worldbank database (World Development Indicators).

After joining the EEC, the weight of R&D in GDP, in Portugal, increased from 0.4% in 1986 to 0.8% in 2005. In 2009, this indicator rose to 1.6%, but became stable around 1.4% in 2012. This evolution allowed Portugal to converge with the EU. In fact, if in 1995 this indicator represented about a third of that for the EU average; in 2009, it reached the maximum of 82% of the EU average. However, after 2009, the economic conjuncture threatened the objective in line with the strategy Europe 2020 of increasing R&D spending to 2.7% of GDP. Currently, Portugal is one of the most lagging MS regarding innovation capability, especially concerning patent applications (Mateus, 2015). From 1986 to 2012, on average the number of registered triadic patents in Portugal represented only 1.3% of the EU-28 average.

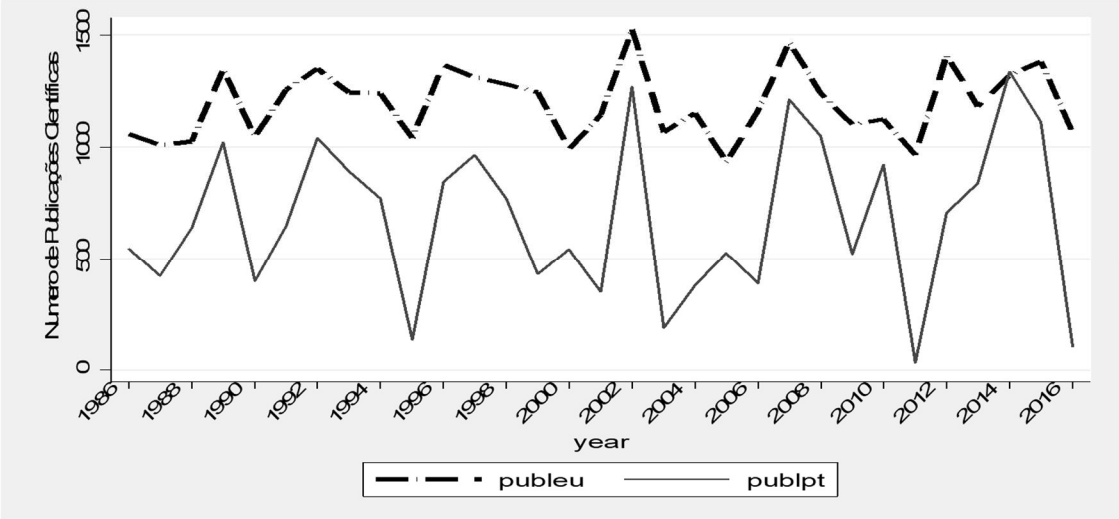
Figure 6. Number of patents, average EU-28 and Portugal (1986-2016)



Notes: patenteu denotes patents in the European Union and patentpt denotes patents in Portugal. Source: PORDATA

Figure 7 shows the number of scientific publications in Web of Knowledge, concerning the EU-28 and Portugal over the period 1986-2016.[9] The number of Portuguese scientific publications represented on average nearly 55% of that of EU-28 per year. The number of publications in Portugal was much more volatile in the period, with an average of 678 publications per year, than that of EU-28, with an average of 1195 publications/year.

Figure 7. Number of Publications (ISI -Web of Knowledge), average EU-28 and Portugal (1986-2016)

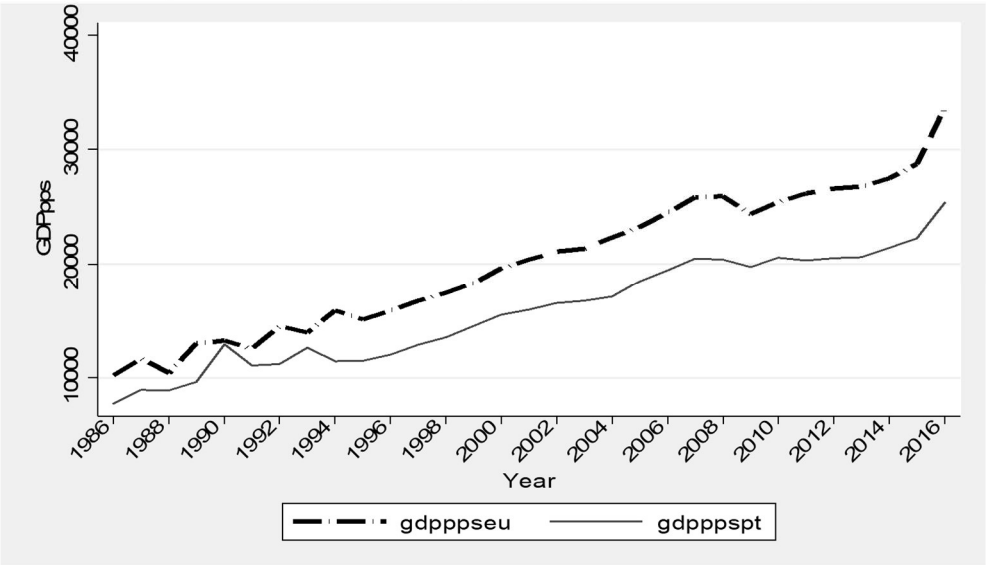


Source: OCEC, Ministry of Science and Higher Education

According to the European Commission (2013), R & D intensity in 2000 to 2011 was on average of -0.16% in Portugal, compared to 0.8% of the EU average. On the contrary, in terms of Excellence in S & T, in 2005-2010, Portugal had a better performance than the EU average (4.23% and 3.09%, respectively). Regarding Innovation and structural change, in 2010-2011, Portugal represented only 62% of the EU average, concerning the Index of economic impact of innovation (0.38% and 0.61%, respectively). Yet, in 2000-2010, the Portuguese performance regarding knowledge-intensity was well above that of the EU average (3.18% and 0.93%, respectively). Regarding the absorptive capacity indicators, we start with the Income and Development Level. The GDP per capita in Portugal represented 76% of the EU average both in 1986 and 2016. On average, the GDP per capita expressed in PPPs in Portugal was 79% of the EU28 average over the period 1986- 2016 (see Figure 8).

[9] It is an integrated Web platform that provides information for research.

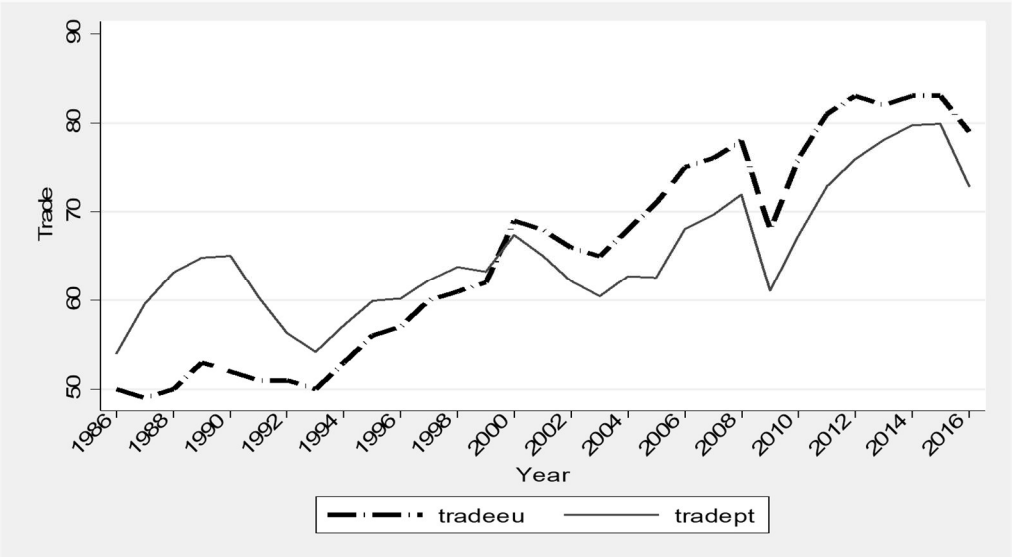
Figure 8. GDP per capita in pps, average EU-28 and Portugal (1986-2016)



Notes: eu denotes European Union and pt denotes Portugal. Source: PORDATA

However, regarding this indicator, the distance between the EU-28 average and Portugal has increased when compared with the situation in late 1980s and early 1990's, soon after the EEC accession. Turning to international trade, Figure 9 shows fluctuations in 1986-2016, with peaks in every 7-10 years' periods, i.e. in 1990, 2000, 2008 and 2015.

Figure 9. Trade (% of GDP), average EU-28 and Portugal (1986-2016)



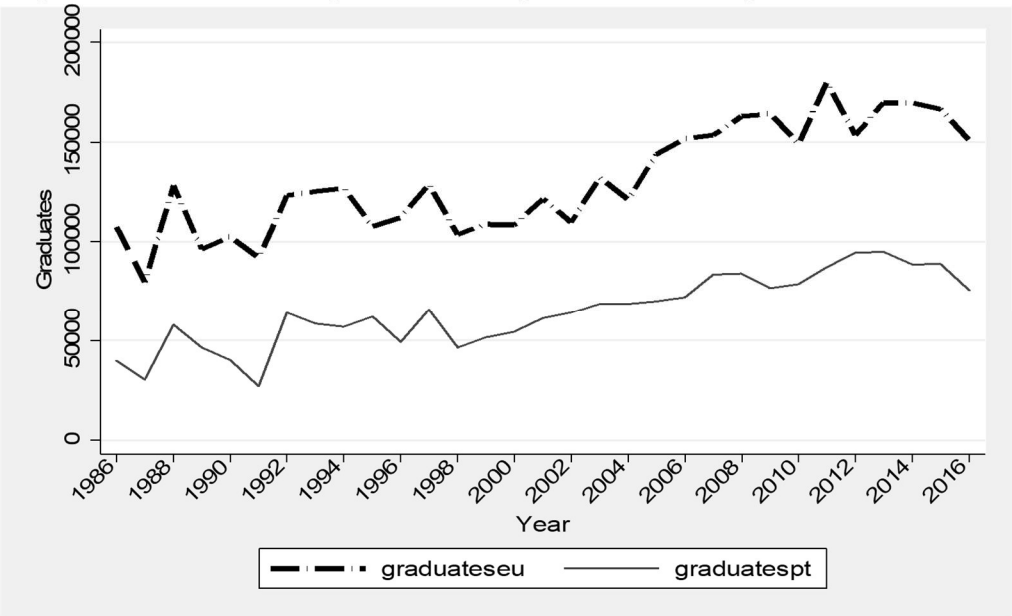
Notes: eu denotes European Union and pt denotes Portugal. Source: Worldbank database (World Development Indicators).

We can split the period under analysis in two subperiods: the first starting in 1986 until 2000, when the Portuguese economy showed a greater dynamic concerning international trade, as a share of GDP, than that of the EU-28 average; and after the year 2000, when the situation was reversed and Portugal became less dynamic regarding trade openness.

The analysis of Figure 10 shows that the number of total graduates (male and female) from 1986 to 2004 has been increasing in Portugal. However, the distance from the EU-

28 average remained stable. After 2004 the distance widened and, after 2013, we can observe a tendency of decrease regarding the number of graduates both in Portugal and the EU.

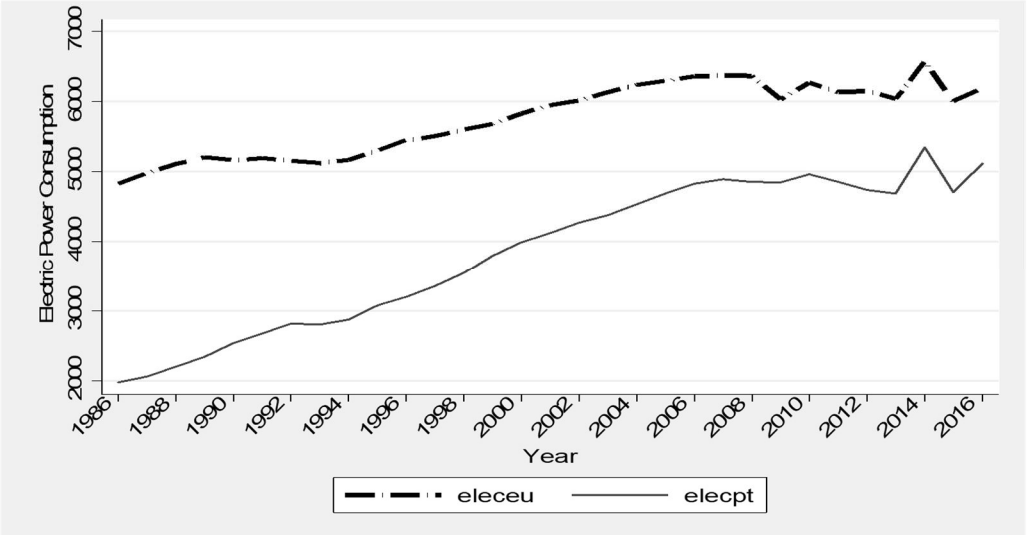
Figure 10. Total number of graduates, average EU-28 and Portugal (1986-2016)



Notes: eu denotes European Union and pt denotes Portugal. Source: PORDATA

The electricity consumption in Figure 11 shows an increase over the period, similar to the evolution in the remaining EU countries. However, the rate of growth has been higher in Portugal and, as a result, the distance has narrowed about one half, compared with the consumption in 1986.

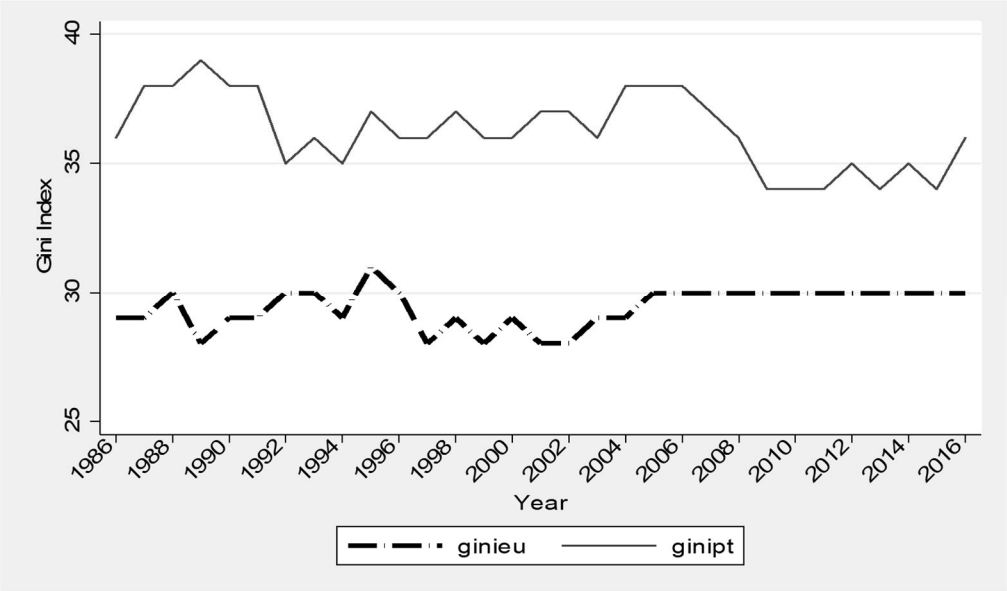
Figure 11. Electric Power Consumption (kWwh per capita), average EU-28 and Portugal (1986-2016)



Notes: eu denotes European Union and pt denotes Portugal. Source: Worldbank database (World Development Indicators).

Finally, the Gini coefficient (Figure 12) measures income inequality ranging from zero for countries with no income inequality and one for countries with the greatest possible income inequality.

Figure 12. Gini Index (%), average EU-28 and Portugal (1986-2016)



Notes- eu denotes European Union and pt denotes Portugal.Source: Pordata

According to the OECD database, in 2011-2012, Portugal improved its position from 0.343 to 0.338. During this period, Portugal was the ninth most unequal country among the 34 OECD countries, with a rate above the average rate of 0.315. 10% of the richest Portuguese population concentrated 25.9% of the income, while 10% of the poorest population concentrated only 2.6% of the income. The bulk of the income (63%) was concentrated on 40% of the population. These high levels of inequality may have a negative effect on the productivity gap. In the period described, income inequality decreased only 4%. According to ISCTE data from the inequalities observatory, Lithuania recorded the greater income inequality in 2009, with a Gini coefficient of 37%, closely followed by Latvia with 36%. Portugal, along with Spain, recorded the third highest indicator of 34%. In a nutshell, from the analysis of the indicators in the previous section, although Portugal has managed to improve its innovation gap, it seems it has failed to convert this into real economic convergence. In this context, the R&D intensity and the level of qualifications are regarded as major difficulties that prevent the increase of competitiveness of the Portuguese economy, affecting the potential growth of output. On the other hand, the improvement in innovation has occurred mostly in the public sector, while scoring on business innovation performance remains low (Veuglers and Mrak, 2009). Still, in recent years, the restrictions in the public finances motivated by the external debt, had interrupted the growth path of R & D investment financed by public funds, while the adverse economic context due to the financial crisis had a negative impact on firm innovation, including business cooperation with the R&D institutions. Moreover, innovation alone is not enough to increase productivity. Laggard economies must possess the ability to absorb, internalize and utilize the knowledge potentially made available to them. In other words, the absorptive capacity allows them to be able to generate new technologies and use resources efficiently, to increase productivity (Narula,

2004). The indicators of absorptive capacity reflect in general an improvement in absolute terms. However, the distance between Portugal and the EU-28 average has widened, except in those indicators concerning infrastructures and inequality. In order to get some insights on the role of FDI flows to innovation and absorption capacity in Portugal and to the convergence of gross value added between Portugal and the European Union countries, we conducted a correlation test to verify the relationship degree between FDI inward flows and the Innovation system indicators as well as with the gap between the Portuguese gross value added towards European Union countries.[10] The correlation coefficients are shown in Table 10.

Table 10. Correlations between FDI flows and Inovation system indicators and gap, 1986-2016

	FDI	R&D	Pub.	Patents	GDPpc	Trade	Graduates	Electric	Gini	Gap
FDI	1.00									
R&D	0.66*	1.00								
Pub.	0.18	0.28	1.00							
Patents	0.84*	0.71*	0.19	1.00						
GDPpc	0.89*	0.48*	0.04	0.65*	1.00					
Trade	0.76*	0.49*	0.18	0.67*	0.77*	1.00				
Graduates	0.88*	0.50*	0.20	0.74*	0.83*	0.71*	1.00			
Electric	0.89*	0.44*	0.05	0.65*	0.96*	0.69*	0.83*	1.00		
Gini	-0.56*	-0.46*	-0.16	-0.63*	-0.47*	-0.34	-0.60*	-0.44*	1.00	
Gap	0.37*	-0.02	-0.08	0.06	0.53*	0.18	0.37*	0.66*	-0.12	1.00

Note- * significant at 5% level. Pub denotes publications. Source: own calculations in Stata 13.0

The correlations between FDI inflows to Portugal and the innovation indicators are strong (coefficient>0.5), positive and significant (at 5% level), except for scientific publications. Regarding the absorptive capacity, all indicators are positively and strongly correlated with FDI inflows, except for Gini index, which shows a negative, strong a significant correlation (-0.5664). Since the higher the Gini index, the larger the inequality, it may be the case that FDI inflows have been contributing to reduce economic and social inequality in Portugal. Finally, the gap between Portugal and the European Union Countries is positively and significantly correlated with FDI inflows, GDP per capita, the number of graduates and the electric power consumption. Since the higher the value of the GAP indicator, the greater the convergence with the European Union Countries, the sign of correlations may indicate that FDI flows have been contributing to reduce the gap. Moreover the increasing number of graduates, increases the absorptive capacity of the Portuguese populations and this may have an impact on convergence of GVA towards the European Union Countries. Since the value of the coefficient is strong for the GDP per capita and the electric power consumption it may imply that those indicators may have a strong impact on reducing the gap. The statistical significance of correlation coefficients specify that all chosen indicators are valid for the analysis of the contribution of FDI inflows to innovation and absorptive capacity, except for scientific publications. Tables 11 and 12 show the goals of Technological plan and Portugal 2020, aiming to converge with the EU-28 average.

[10] Data on Gross value added (current basic prices in millions of Euros) for Portugal and the aggregate European Union Countries comes from EUKlems database- November 2009 release, March 2011 update.

Table 11. Goals of Technological Plan, aiming to reduce the technological gap, 2005

	Goal
Human resources allocated to R&D and scientific publications in international journals	+50%
Number of PHDs in Portugal and abroad	1500
Private expenditure on R & D	+300%
Public expenditure on R & D	1% of GDP (+200%)
Public R & D activities	+1000 jobs
Number of registered patents	+300%

Source: https://infoeuropa.eurocid.pt/files/database/000035001000036000/000035449.pdf, p.26

Table 12. Goals of Portugal 2020, aiming to converge with the EU-28 average, 2014-2020

Indicator	Objective	Measure	Goal (PT2020)
Innovative capability	Reinforcement of R&D and Innovation	R&D (% GDP)	2.7%- 3.3%
Absorptive capacity	More and better education	% Population with higher education or equivalent (30-34 years old)	40.0%
	Fight poverty and social inequalities	People at risk of poverty (compared to 2008)	-200,000

Source: Adapted from http://ec.europa.eu/europe2020/pdf/nd/prgrep2013_portugal_pt.pdf, p.9

It has been argued that the difficulties in the convergence process are not related to factor intensity or technological progress but with the contribution of efficiency to TFP. Indeed, from 1986 to 1998, structural change was characterized by a transfer of labour from agriculture to services; while the weight of the manufacturing employment has remained broadly stable and output has declined. TFP can be expressed in terms of technology growth and efficiency. The former includes the effect of positive externalities which is a driver of economic growth. Amador and Coimbra (2007) show that, in 1995-2005, the contribution of efficiency was negative due to investment in real assets with low return, such as housing. Since many services are non-tradable, this resulted in lower productivity gains and lower the average contribution of TFP to economic growth to merely 0.2% in 1990-2000. Hence, the inclusion of both tradable and non-tradable sectors can hinder the analysis of structural change, as measured by the TFP performance. According to predictions of the EC (2016): "As economic conditions are expected to improve and investment to pick up, capital accumulation would eventually raise the growth potential. Prospects for labour force development are less optimistic." (op. cit, p.8). In contrast, the TFP of the Portuguese economy is expected to improve slightly in the medium term. Nevertheless, the low average skill level of the labour force, although improving, and the low level of innovation may deter the growth of the TFP.

Being a small open economy located on the outskirts of Europe, Portugal is vulnerable to external factors that hamper economic growth. The competitiveness problems of the Portuguese economy were also reflected in the decrease of FDI flows. Yet, sectoral

empirical studies exist that, by estimating externalities from FDI via backward and forward linkages for the Portuguese manufacturing industry, allow to design FDI policies aimed at this specific industry. In this context, FDI policies may put forward suitable incentives to reach the FDI sectoral composition that enhances greater TFP growth for domestic firms, through externalities from FDI via backward and forward linkages.

4. POLICY RECOMMENDATIONS TO BOOST PRODUCTIVITY AND GROWTH

Based on previous sections, we make some recommendations on the design and implementation of FDI policies in articulation with industrial policy, i.e., according to the type of FDI externality, technological groups and/or specific manufacturing industries. One should notice that, a more comprehensive ex-ante evaluation of FDI policy would also apply to other sectors. In such scenario, we would most probably be led to a choice of a mix of FDI in manufacturing and services. However, this is beyond the scope of our research. These recommendations consider a logical framework for intervention to ensure causal linkages between, on the one hand, the specific goals and constraints associated with strengthening the articulation between FDI and Industrial policies, and, on the other hand, between the proposed policy measures/instruments and the expected results. Accordingly, in Table 13, the first policy component goals, determines the rest: constraints, policy measures/instruments, expected results and recommendations. The Policy goals are the increase of manufacturing competitiveness, the reduction of the technological gap, the convergence of productivity, the attraction of FDI and the promotion of economic growth and employment.

Regarding the manufacturing competitiveness, the main barriers to this goal are deindustrialization, international competition, and the highly fragmented value chains. Hence, measures targeting all industries should be taken, such as the promotion of entrepreneurship; access to credit and the strengthen of the intellectual property rights and the competition policy. FDI Policies need to tailor to the specific requirements of investors. If this is accomplished, it is expected that foreign firms, especially in scale-intensive industries in Portugal contribute to increase the turnover, employment, value added and gross operating surplus.

Table 13. Components of the Ex-Ante Evaluation of FDI and Industrial policies

Policy				
Goals	**Constraints**	**Measures/Instruments**	**Expected Results**	**Recommendations**
Strengthen the manufacturing sector, consolidate poles of competitiveness, according to a specialization strategy	-Privatization has increased deindustrialization - Manufacturing is organized in highly fragmented value chains -Competition from emerging economies	-Horizontal measures (targeting all sectors) -Creation of an environment conducive to entrepreneurship - Promotion of businesses angels and venture capital -Flexibility of the labour market -Access to credit -Strengthen the internal market (intellectual property rights, competition policy, infrastructures, and standards)	-MNCs in scale-intensive industries may be the major contributors regarding turnover, employment, value added and gross operating surplus - Foreign firms may have a major role regarding Gross Operating Surplus in the automotive industry, rubber and plastics and non-metallic minerals - Subsidiaries may create a larger number of jobs in the automotive, food and electrical equipment industries.	-Policies need to tailor to the specific requirements of investors, and be difficult to replicate elsewhere -Industrial policy should contribute to: achieving higher levels of competitiveness through increased industrial productivity. Accordingly, it should: - Address systemic failures and attract FDI projects that lead to positive externalities -Conceal horizontal policies that support the manufacturing sector, with vertical policies targeting specific sectors
Reduce the technological gap	-Lack of fluidity in the technology transfer processes from universities and other R&D institutions to domestic firms - Low level of innovation capabilities of domestic firms - Government incentives for innovation have been reduced - Difficulty in adopting modern production techniques, organizational practices and in creating new products	Technological Plan: - Stimulate innovation - Enhance cooperation between firms and scientific and technological organizations -Inclusion of PhDs in domestic firms through financial incentives for SMEs -"Horizontal" emphasis on research strategies and the promotion of industry-wide innovation to increase productivity and economic growth	According to the technology-accumulation hypothesis, if the gap is too large, domestic firms do not possess the necessary "absorptive capacity" to incorporate the knowledge of foreign firms.	-Innovation facilitates structural change towards economic activities with high added value -Structural change via technological change. - The change of Portugal's specialization towards techno-low and capital-intensive products should continue.

Notes- Because the measure of technological gap is inverse, e., constructed as the ratio of labour productivity of domestic firms to foreign firms, the higher the value the greater the technological sophistication of domestic firms.
Source-Author's own elaboration

Table 13. Components of the Ex-Ante Evaluation of FDI and Industrial policies (cont.)

Policy				
Goals	**Constraints**	**Measures/Instruments**	**Expected Results**	**Recommendations**
Real convergence of productivity	- Erosion of competitiveness and aggravation of external accounts - investment and allocation of resources (labour) for non-tradable services - Specialization in sectors of low technological intensity and weak capacity to generate knowledge adaptable to production needs - Low average labour qualification and low level of innovation can hinder TFP's growth	Focus on the manufacturing as a driver of economic recovery	Reduce the disparity in labour productivity in the Portuguese economy	The convergence process in Portugal must be assisted by a reinforcement of supply-side measures with an integrated industrial policy, favouring certain industries where there is evidence of positive externalities from FDI
Attract FDI and promote economic growth and employment	-Investment policy moving from national to European level -Stiff public budget -Limited scope of most FDI strategies through incentives - Difficulty of IPAs in identifying business opportunities for target firms	-Encourage FDI through incentives funded by Structural Funds -Special visa regime -Priority industries: heavy industry; traditional industries; and industries with comparative advantage (electrical equipment, computers and electronics). -Transparency of public finances - Promptness of judicial procedures - Liberalization of the product market -Improve regulation	Foreign presence may contribute to an increase of domestic firms' TFP	FDI policy should: -Compare the benefits of attracting FDI projects with the costs in terms of the public budget - Align investor motivation with the country's development strategy - Protect and enable investment liberalization by removing obstructions (Particularly in the framework of mergers and repatriation of income) State aid rules need to: - Adopt a sectoral and multisector approach - Consider the economic impact of the project and the fulfilment of the contractual obligations; - Consider the tax laws of the country of origin and the agreements governing taxation between the two countries.

Notes- Because the measure of technological gap is inverse, e., constructed as the ratio of labour productivity of domestic firms to foreign firms, the higher the value the greater the technological sophistication of domestic firms.
Source-Author's own elaboration

Thus, policy recommendations include the promotion of structural change towards economic activities with high added value via technological change. However, the major obstacles regarding the reduction of technological gap are the lack of fluidity in the technology transfer from universities to firms, low level of innovation capabilities and the reduction of public incentives for innovation, since R&D activities are expensive and small firms may be discouraged to pursue innovation in the absence of some public funding. To accomplish this goal, measures should be taken to stimulate innovation and cooperation between firms and scientific organizations.

Concerning the barriers to the convergence of productivity, the main are the erosion of competitiveness, the allocation of resources to non-tradables, the specialization in sectors of low technological intensity and the low average of labour skills. Hence the focus on the manufacturing as a driver of economic recovery aims to reduce the disparity in labour productivity towards the EU-28 average. In order to close the gap, the convergence process must be assisted by a reinforcement of supply-side measures and simultaneously it must favour certain industries where there is evidence of positive externalities from FDI. Finally, barriers to attracting FDI and promote economic growth and employment are the fact that the Investment promoting policy is moving to European level and thus leaving the government with no autonomy to pursue such a FDI promoting policy prone to maximize externalities from FDI; the public budget constraints, the FDI strategies with narrow scope, and the difficulty of IPAs to identify business opportunities. Measures include Structural Funds, the special visa regime, the definition of priority industries and the improvement of the institutional environment. If authorities are successful in attracting the right kind of FDI projects, it is expected at the aggregate level, that an increase of one percent in turnover of foreign firms in downstream and upstream industries may contribute to an increase of domestic firms' TFP of 0.0629 and 0.306 percentage points. This analysis seeks to contribute to the drawing up of a well-defined strategy. Thus, it is possible to state that the general objectives set out are in line with the major constraints posed by policies analysed here and thus constitute an appropriate starting point for further strategic specification. In this respect, the low levels of qualification of the population, the maladjustment of the articulation with the labour market; and the persistence of areas of inefficiency and the lack of innovation conform the main constraints. Finally, the system of goals and measures/instruments is articulated with the indicators of innovation and absorptive capacity. There are explicit synergies between specific objectives and measures/instruments. In this context, the selected indicators are generally relevant and their formulation clearly expresses the associated measurability dimension. The indicators use appropriate calculation methods and present realistic values against the objectives and resources.

Regarding Investment priorities, the Portuguese Investment Promotion Agency (AICEP) aims to attract foreign Investment focusing into three groups of priority industries: heavy industries that rely on domestic sources of raw materials (iron, copper, lead and zinc); traditional industries such as textiles to increase the competitiveness; and industries in which Portugal already has a comparative advantage (e.g. electrical equipment, electronic equipment and telecommunications).

Main Recommendations. It will be useful to highlight that the proposed intervention strategy concentrates preferentially its attention on the effort to achieve higher levels of competitiveness through increased industrial productivity. Attention has been drawn to strengthening structural change towards economic activities with high added value, since technological change appears to be the only route available to achieve economic growth. Thus, the design of public policies analysed here has a strong affiliation to the set of policy instruments established in the context of the Structural Funds. Therefore, FDI Policies need to be tailored to the specific requirements of investors (for example, in compliance with the tax laws of investor's countries and the tax agreements between the two countries). Also, these policies should be difficult to replicate by other governments, in order that the host country will able to attract the desirable FDI projects. Examples of such measures are the creation of hubs of firms with high-skilled workforce and/or management expertise.

Regarding the Industrial Policy, in addition to the horizontal focus that support the whole manufacturing sector; it must also target the specific industries (vertical focus) where FDI generates positive externalities. Indeed, the quality and effectiveness of public policies analysed here, requires the assistance of supply-side measures with an integrated industrial policy, favouring scale intensive sectors, where there is evidence of positive externalities from FDI. Hence, FDI incentives should target that technological group instead of individual firms, after performing a balance between the benefits and costs (public budget) and aligning investors' motivations with the country's development strategy.

5. CONCLUSION

Being a small and moderately innovative economy, without the locational advantages of the CEECs, the potential convergence of the Portuguese economy is threatened due to several factors that caused a fall not only in FDI flows, but also in production and employment, which were not fully compensated by government incentives for innovation activities, which in most cases were limited.

Based on the analysis of the Innovation System indicators, although Portugal has managed to improve its innovation activities, the distance between Portugal and the EU-28 average has increased, except for the indicators related to infrastructures and inequality, and the economy has not been able to converge with that average. According to the OECD Reports (Portugal), several weaknesses persist such as the scarcity of human capital and the difficulties to adopt more modern production techniques, organizational practices and new products. Thus, the main challenge for Portugal is to increase productivity on a sustained basis. The path of sustainable growth goes through a process of structural transformation via technological change. In this context, the manufacturing sector, being one of the main producers of tradable goods and higher rates of productivity and innovation is considered the main engine of economic growth. In addition, the numerous technological linkages within the manufacturing industries enable the technological change. In this context, FDI is considered the main vehicle of technology transfer, since it represents the greatest source of innovation, (Lim, 2001). A greater foreign presence within an industry is correlated with the growth of TFP of domestic firms by increasing the speed of technology transfer. Historically, FDI has contributed to the structural change of Portuguese exports to technology-intensive industrial activities.

The changes that recently occurred in industrial policy were accompanied by new strategies, such as the resumption of focus on productivity and merging with innovation

policy to support research and education. In this context, the European Commission (EC) plays an important role about the Government incentive system for innovation activities in Europe, with a view to improving the competitiveness of firms. Thus, aim of this paper is to evaluate the impact of FDI inflows to manufacturing TFP in Portugal and, therefore, on the process of convergence with the EU-28 average. This exercise can provide policy recommendations to boost productivity and stimulate growth. Though, with the acceleration of globalization that began in the new millennium, FDI inflows to the Portuguese manufacturing sector have become more volatile. Thus, we analysed the joint evolution of FDI inflows to the manufacturing sector and the factor contribution to the GVA increase in the manufacturing for 1986-2016, in search of a hint on the FDI impact on the manufacturing TFP. Our analysis has shown that FDI flows targeting this sector potentially help to narrow the gap with the TFP. However, in order to grow and converge, Portugal need a well-defined FDI policy that aligns investors' motives with the national development strategy; that uses the funds according to the objectives; that performs a continuous assessment to ensure its effectiveness; and makes the necessary corrections. On the other hand, the industrial policy must reconcile the horizontal focus that support the development of industry in general, with a vertical focus, i.e., on specific sectors. This is critical for attracting FDI projects that generate positive externalities for domestic firms. In this respect, the importance of subsidiaries in job creation in 1986-2016 was greater in scale-intensive industries and in science-based industries (e.g., automotive, food, rubber and plastics and chemicals). In order to boost productivity, an integrated industrial policy must be established, favouring scale-intensive sectors where there is evidence of positive externalities from FDI. In the past, economies of scale have encouraged technical progress in Portugal. Therefore, FDI incentives should be used to attract this technological group of industries, aligning investors' motives with the country's development strategy. In addition, the proposed intervention strategy should aim at reinforcing structural change towards high value-added economic activities, as technological change seems to be the only way available to achieve economic growth. In this context, clusters play an important role in improving the attractiveness of a region to FDI, providing local capacities that influence the location of economic activities. In our view, it is only under these conditions that Portugal can resume the path of convergence with the European Union countries.

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APPENDIX A

Table A1- Portuguese Innovative System Database: description and basic statistics, 1986-2016

Obs=31

Variable	Description	Unity	Mean	Std. Dev.	Min	Max	Source
rdeu	R&D expenditure EU-28	% GDP	1.81	0.11	1.63	2.02	PORDATA
rdpt	R&D expenditure Portugal	% GDP	0.94	0.38	0.40	1.58	PORDATA
patenteu	Patents EU-28	Number	16,713.84	7,123.95	5,526.00	26,816.00	PORDATA
patentpt	Patents Portugal	Number	214.55	207.27	54.00	722.00	PORDATA
publeu	Scientific publications EU-28	Number	1,195.06	156.07	933.00	1,526.37	OCES Ministry of Science
publpt	Scientific publications Portugal	Number	677.54	353.58	33.00	1,336.00	OCES Ministry of Science
gdpppseu	GDP PPS EU-28	pps	20,070.03	6,208.78	10,183.00	33,582.00	PORDATA
gdpppspt	GDP PPS Portugal	pps	15,803.29	4,704.40	7,713.00	25,385.00	PORDATA
tradeeu	(imports+exports) EU-28	% GDP	65.35	11.93	49.00	83.00	PORDATA
tradept	(imports+exports) Portugal	% GDP	65.22	7.03	54.01	79.90	PORDATA
graduateseu	Graduates EU-28	Number	130,635.30	26,674.09	79,526.00	180,095.00	PORDATA
graduatespt	Graduates Portugal	Number	64,688.38	18,147.94	27,182.27	94,867.00	PORDATA
eleceu	electric power consumption EU-28	Kwat	5,751.96	512.52	4,825.00	6,568.00	PORDATA
elecpt	electric power consumption Portugal	Kwat	3,839.40	1,053.64	1,974.54	5,342.17	PORDATA
ginieu	Gini Index EU-28	Number	29.41	0.80	28.00	31.00	PORDATA
ginipt	Gini Index Portugal	Number	36.25	1.45	34.00	39.00	PORDATA

Source- Author's own elaboration.