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The Effects of Product Market Reforms in Portugal: A More Productive, More Efficient and More Resilient Economy?

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Abstract

This paper assesses the short-term impact of product market deregulation in upstream sectors on the productivity of firms in downstream sectors (i.e. those firms using the output of the reformed sectors as inputs in their production process). Relying on a firm level database for the period 2004-2014 covering all Portuguese firms, we show that the most productive firms (those at the sectoral technological frontier) grasp short-run benefits from these reforms, which are then spread to all other firms via spillover mechanisms. In addition, reforms potentiate the exit of the least productive firms, improving the resource allocation in the economy. Finally, we show that the adoption of product market reforms in upstream sectors leads to a more resilient economy, better equipped to face adverse shocks.

***JEL Classification**:* D04, D22, L43, L51

Keywords: Product Market Reforms; Total Factor Productivity; Reallocation of Resources; Resilience to Shocks

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I dedicate this work to those who have always been with me during this fascinating academic journey: family, friends and professors.

1 Introduction

In recent years, Portugal implemented a large number of structural policies aimed at increasing productivity and improving resilience to shocks. Reforms covered many areas, such as the labour market, education and skills, the judicial and fiscal systems and several product market frameworks.

Product market reforms were a key area, given the dimension of the pre-existing challenges and the expected payoffs.[1] In 2008, Portugal ranked 26th out of 34th countries in the OECD Product Market Regulation, which assesses the degree of flexibility in the sector.[2] In this context, the product market reform agenda was exhaustive and includes: liberalization of gas and electricity markets, with the phasing out of regulated tariffs; negotiations with energy producers to reduce rents and eliminate the tariff debt; creation of a transports regulator; reduction of ports operating costs; a new telecommunications regulatory framework, including the reduction of termination rates and lower restrictions on customers mobility; a competition enhancing framework in the postal sector; several steps in the direction of the liberalisation of 19 regulated professions. A number of overarching measures such as the revision of the competition law and improved enforcement (e.g. with the creation of specialized courts) and the elimination of State special rights in private companies were also adapted. These measures, aimed at fostering competition, and reducing the excessive rents of sheltered sectors, allowing for a more efficient resource allocation, increased productivity levels and enhanced resilience to shocks. As a consequence, between 2008 and 2013, Portugal climbed 14 places in the OECD's Product Market Regulation ranking, and reached the 12th position.

[1] Several studies show that product market reforms produce the largest economic gains when compared to other reforms (see, for instance Égert and Gal, 2016 and Barnes et al, 2013).

[2] The country ranked 1st being the more flexible in terms of product market regulations. The index is a *de jure* measure, thus not assessing outcomes.

The Office for Economic Policy and International Affairs (GPEARI) of the Portuguese Ministry of Finance is mandated to assess the *ex-ante* and *ex-post* macroeconomic impact of structural reforms. This project is part of a partnership between the GPEARI and Nova SBE to develop analytical work in this context. By using firm-level data from 2004 to 2014 and the OECD's PMR indicators, we assess the impact of the liberalization of product markets in Portugal on firms' productivity, reallocation of resources and resilience to shocks. In particular, we consider the effect of deregulation of product market sectors in downstream industries, i.e. on firms using these markets' output as input to their production process. This is possible due to a newly available OECD dataset relying on input-output matrices (Égert and Wanner, 2016).

Given that the reforms are recent and our available firm-level time series are relatively short, we focus mainly on short-run effects. This is particularly relevant for the political economy of the reform process, as its potential short-term costs, if not well communicated and properly addressed, may undermine support and promote reform fatigue. In fact, while long-term gains of product market reforms are well established (see e.g. IMF, 2015 and OECD, 2015), they may take some years to materialize and even be negative in the short-run. Lower rents lead to the exit of incumbent firms (while firm entry occurs only in the medium-term), thus contracting aggregate supply and increasing unemployment, which in turn reduces aggregate demand. In addition, innovating firms have immediate costs but only longer-term (uncertain) gains. Aggregate demand may also contract in the short-run if reforms increase agents' uncertainty, leading them to higher savings and less consumption.

We provide the following contributions. Firstly, we analyse the short-term impact of reforms, showing that deregulation in upstream sectors increases productivity growth for the most productive firms (those at the technological frontier), but not for the others (the so-called laggards). However, the laggards benefit from second round effects, as we also show that there are spillovers

from frontier firms to the others, both via diffusion and catching up mechanisms. The short-run effects of reforms are heterogeneous across sectors, possibly due to different competitiveness structures and the position over the cycle.[3]

Secondly, we assess how the reforms affect firms' exit and resilience to shocks. Using a probit model, we show that less productive firms are more prone to exiting the market under a more flexible regulatory setting. Relying on a difference-in-differences estimation and comparing two groups of firms – one more affected by the reforms and the other not as much – we also show that reforms allow firms to better manage the 2011 crisis, with a lower reduction in productivity.

This work allows for fine-tuning existing reforms and improving the design of future reforms; moreover, the evidence on the benefits of already enacted reforms is key in promoting ownership. This is particularly important in product markets, where vested interests are in general a strong impediment to reforms (given that costs are concentrated on a small number of stakeholders, while gains are diffuse).

The work project proceeds as follows: Section 2 explores the most relevant literature, and Section 3 introduces the database and the variables. We present the methodology in Section 4 and the empirical results in Section 5. Finally, Section 6 concludes.

2 Literature Review

The long-run positive impact of product market reforms on productivity and growth is a well-established result both in model-based literature (Arpaia et al. 2007; Everaert and Schule, 2008; Andrés, Arce and Thomas, 2014; IMF, 2016) and in econometric studies relying on aggregate,

[3] For instance, the impact on hotels and restaurants is overall positive, which may be due to the competitive pressures that were introduced in the sector. A higher output-price elasticity implies that price reductions translate into higher output. Conversely, in the construction sector the effects are overall negative, since, as described in the literature, short-term costs of reforms are amplified during downturns (that particularly affected the construction sector).

sectoral and firm-level data (Égert and Gal, 2016; Arnold and Barbosa, 2015; Barnes et al., 2013; Bouis and Duval, 2011; Bouis et al. 2012; IMF, 2015; and OECD, 2015).

However, model-based simulations show that these long-term gains may come after short-run costs, particularly at the lower bound zero interest rate (Eggertsson et al., 2013), in small open economies (Cacciatore et al., 2016) or during downturns (IMF, 2016). The empirical evidence on short-run impacts is mixed. For instance, while Cacciatore and Fiore (2015) and Bouis et al. (2012), using aggregate data for a set of OECD countries, find evidence of these costs, Gal and Hijzen (2016), using firm-level data for 18 advanced economies, and Barone and Cingano (2011), using industry-level data for a set of OECD countries, show that gains are visible already in the short-run. Firm-level national studies, such as Forlani (2012) for France, and Lanau and Topalova (2016) for Italy, also provide evidence of short-term gains.

These results suggest that contextual factors are important in determining the sign of short run effects. The literature using aggregate (Adhikari et al., 2016, Bouis et al., 2012, Égert and Gal, 2016), sectoral (Nicoletti and Scarpeta, 2003, Dabla-Norris et al., 2015, Gal and Hijzen, 2016) and firm-level data (Santos et al., 2017, IMF, 2016, Bourles et al., 2013), show that (i) the economic cycle, (ii) technological spillovers, (iii) sectoral differences, (iv) firm productivity and (v) initial framework conditions and interactions with other reforms may explain these differences.[4]

Overall, product market reforms increase regulatory flexibility and reduce entry barriers, potentiating a reduction of mark-ups and increased churn-rates. The first effect was already studied for the Portuguese economy (Amador and Soares, 2013 and Folque, 2016). For churn rates, existing literature shows that product market reforms potentiate firm entry and exit (Cincera and Galgau,

[4] The literature assesses the impact of reforms through their direct effect on regulated upstream sectors, such as electricity, gas or telecommunications (e.g. Gal and Hijzen, 2016, Lanau and Topalova, 2016) or via indirect effects on downstream firms that use the output of upstream sectors as inputs (Barone and Cingano, 2011, Forlani, 2012, and Bourles et al., 2013).

2005; Schiantarelli, 2005; Lanau and Topalova, 2016 and Gal and Hijzen, 2016). This reduction in mark-ups and the increased churn rates improve the allocation of resources within the economy, fostering productivity growth.[5]

In addition to higher productivity growth, product market reforms are also expected to improve the economy's shock resilience, a result corroborated by Duval et al. (2007), Ernst et al. (2007) and Pelkmans et al. (2008) at sectoral level and by Cacciatori and Fiori (2016) at firm level.

3 Data

3.1. The Dataset

We use the IES database - *Informação Empresarial Simplificada* (Simplified Corporate Information) provided by INE - *Instituto Nacional de Estatística* (Statistics Portugal), which includes the annual accounts (income statements and balance sheet) of all Portuguese firms as reported simultaneously to the Ministry of Finance, the Ministry of Justice, Bank of Portugal and Statistics Portugal. Data are available from 2004 onwards.

The initial dataset covered 3,916,315 observations for the period 2004-2014.[6] To ensure consistency and robustness of our results, we focus on firms with positive values of assets, turnover, external supplies and services and with non-negative personnel expenses and number of employees. In addition, using the 3-digit level NACE Rev. 3, we exclude specific sectors, namely financial activities and insurance services, health care, entertainment, domestic staff and international organizations, given the specificities of their business models. With these exclusions, we reach a dataset of 3,199,118 observations (A similar clean-up procedures were followed for

[5] Foster et al. (2001) and Restuccia and Rogerson (2007), using US firm-level data, show that a better resource allocation leads to productivity improvements.

[6] We focus solely on companies and we have thus excluded individual entrepreneurs (*empresários em nome individual*).

instance by Gal and Hijzen, 2016). Moreover, due to lack of data, we are not able to compute Total Factor Productivity (TFP) for around 300,000 firms, leaving us with a total of 2,892,449 firms.[7]

3.2. Variables

This section describes the variables used in this study. The main performance variable is TFP, although we also compute Labour Productivity (LP) (output per worker), for robustness checks. TFP was computed using the Levinsohn and Petrin (2003) estimation method, which addresses the endogeneity problem arising from methods such as OLS or fixed-effects estimators.[8] The technological frontier was defined as the firms in the 90th percentile for the estimated TFP, by year and sector. Firms outside the technological frontier are labelled as laggards. The distance to frontier is the productivity gap between laggards and frontier firms, and is computed for each laggard firm as the difference between its TFP level and the lower bound value of the productivity at the frontier, for each year and sector.

Sectoral fixed effects are constructed using the 3-digit level NACE Rev 3.[9] Region fixed effects are obtained with the NUT 2 Portuguese region division.[10] Additionally, firm size controls are included. Following Statistics Portugal methodology, we constructed each firm-size bracket according to the conditions presented below in Table 1.

[7] Please refer to Section 3.2. for detailed information about Total Factor Productivity (TFP).

[8] As the authors argue, when estimating production functions, one must account for the correlation between input levels and productivity, as otherwise one gets inconsistent estimates of the parameters of the production function. Therefore, they develop an estimator using intermediate inputs to proxy for the unobservable productivity term. To compute the TFP, we rely on the STATA code developed by Petrin, Poi and Levinsohn (2004), using external supplies and services as a proxy for intermediate inputs.

[9] The included sectors are Agriculture, hunting, forestry and fishing; Mining and quarrying; Food products, beverages and tobacco; Wood and products of wood and cork; Pulp, paper, paper products, printing and publishing; Coke, refined petroleum products and nuclear fuel; Chemicals and chemical products; Rubber and plastics products; Other non-metallic mineral products; Textiles, textile products, leather and footwear; Basic Metals; Fabricated metal products except machinery and equipment; Machinery and equipment n.e.c; Motor vehicles, trailers and semi-trailers; Other transport equipment; Electricity, gas and water supply; Construction; Transport and storage; Post and telecommunications; Real estate activities; Office, accounting and computing machinery; Electrical machinery and apparatus n.e.c; Radio, television and communication equipment; Medical, precision and optical instruments; Manufacturing n.e.c and recycling; Wholesale and retail trade, repairs; Hotels & Restaurants; Renting of machinery and equipment; Computer and related activities; Other Business Activities; Research and Development.

[10] This division includes 7 regions, covering Mainland Portugal and Islands.

Table 1 - Firms' Type

Type of Firm	Number of Workers		Output
Micro	<10	and	<2 Million
Small	>10 and <50	and	>2 Million and <10 Million
Medium	>50 and <250	and	>10 Million and <50 Million
Large	>250	or	>50 Million

Source: Statistics Portugal

Table 2 presents the descriptive statistics. The firms in our sample have an average of 10 workers, 1.2 million € of output and 1.6 million € of assets. 82% of our firms are micro, 15% are small, 2% are medium, and 0.4% are large. Operational costs and cost of employees account for, on average, 0.3 and 0.2 million €, respectively. Frontier firms are, on average, larger – they have a much higher output, their assets are more than the double of those of laggards and their number of workers is also higher. The average annual TFP growth is negative for laggards (-0.05%) but positive for firms at the frontier (+0.24%).[11]

Table 2 - Descriptive Statistics

Variables	Unit	Mean	Std Dev	Min.	Max.	Mean frontier	Mean laggards
Output	10^3 €	1,218	26,700	0	10,300,000	5,214	774
Operational Costs	10^3 €	288	5,621	0	1,820,000	735	238
Cost of employees	10^3 €	174	2,114	0	5,030,00	252	152
Assets	10^3 €	1,586	53,500	0	21,200,000	3,051	1,423
Number of workers	unit	10	89	1	22,734	13	9
Micro Firms	unit	0.82	0.38	0	1	0.72	0.83
Small Firms	unit	0.15	0.36	0	1	0.2	0.14
Medium Firms	unit	0.02	0.15	0	1	0.06	0.02
Large Firms	unit	0.00	0.07	0	1	0.01	0
TFP growth [ΔTFP]	%	-0.02	0.54	-10.76	12.2	0.24	-0.05
TFP growth of frontier [ΔFrontier]	%	0	0.02	-0.6	0.53	-	-
Distance to Frontier [DTF]	*p.p.*	0.86	0.75	0	13.45	0	0.96

Source: Author's own computations using IES data for the years 2004-2014. N= 2.892.449

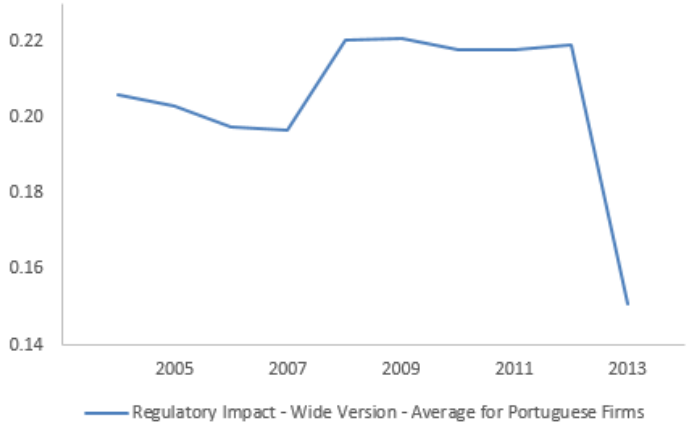
[11] The average growth of the technological frontier is different from this value (0.00%) because we have an unbalanced sample.

The Regulatory Impact variable (*Regimpact)* is an OECD index of the potential costs of the anti-competitive regulation in network sectors, retail distribution and professional services on 37 sectors of the economy that uses the output of these sectors as intermediate inputs (see Égert and Wanner, 2016, for more information). This variable is computed by the OECD by weighing the degree of regulation in the non-manufacturing sectors (*Regnmi*) by the input-output coefficient (*w*) of sector *k* from the non-manufacturing sector *j*:

$$Regimpact_{k,t} = \sum_{j=1}^{n} Regnmi_{j,t} * w_{j,k} \quad [1]$$

We rely on the *wide* version of the indicator, which includes network sectors, retail distribution and professional services as upstream sectors, and use the *narrow* version, which only considers regulation in network sectors, for robustness purposes.[12] Figure 1 shows the evolution of the *wide* indicator between 2004 and 2013.[13]

Figure 1 – Wide Regimpact Evolution



Source: Authors' own calculations based on IES and on OECD's Product Market Regulation Database.

The *treated* and *control* sectors used in the *DiD* estimation have, by construction, very different intensities of electricity and gas input usage: between 4% and 54% of total inputs for the *treated*

[12] For a discussion on the *pros* and *cons* of each type of indicator, see Égert and Wanner (2016).
[13] Appendix A6 presents detailed information on the *wide* and *narrow* indicator for each sector and year.

and from 0% to 1% for the *control*.[14] Table 3 shows that firms in *treated* sectors are more productive but are also smaller, both in terms of number of employees and output. By computing the t statistics for the null hypothesis that the means are equal in the two groups, we find that there are statistically significant differences for output, operational costs, cost of employees, lnTFP, and for the number of workers.

Table 3 - Means of Key Variables

Variable	Unit	Treated	Control	t^a
Output	10^3 €	1,120	1,289	-0
		(28)	(70)	
Operational Costs	10^3 €	164	434	-0.03
		(3)	(10)	
Cost of Employees	10^3 €	118	195	-0.02
		(2)	(4)	
Assets	10^3 €	1,622	1,762	-0
		(81)	(48)	
lnTFP	unit	1.57	1.27	0.20
		(0)	(0)	
Number of workers	unit	8	11	-0.02
		(0.11)	(0.14)	

Source: Author's own calculations using IES data for the years 2004-2014. N= 1.373.056.
[a] Test of equality of means in *treated* and *control* groups.

4 Methodology

We now briefly outline the methodology of each part of the paper.

Firstly, we investigate the relationship between product market regulation in upstream sectors and firms' performance in downstream ones. Our baseline equation is as follows:

$$\Delta TFP_{i,k,t} = \beta_0 + \beta_1 \Delta Frontier_{k,t} + \beta_2 DTF_{i,k,t-1} + +\beta_3 Regimpact_{k,t-1} + \sum_{s=1}^{4} \psi_i D_i + \alpha_k + \alpha_t + \alpha_r + \varepsilon_{i,k,t} \quad [2]$$

[14] Details about the construction of *treated* and *control* groups available in Section 4.

Where $\Delta TFP_{i,k,t}$ is the growth of Total Factor Productivity for firm i in sector k at year t.[15] $\Delta Frontier_{k,t}$ stands for the productivity growth of the sectoral technological frontier within the sector k at time t and $DTF_{i,k,t-1}$ denotes the distance of each firm to its sectoral frontier, which we include to control for spillovers from firms at the frontier, i.e., to assess whether more productive firms are spreading innovative features across the economy through so-called diffusion (or pass-through) mechanisms and catching-up. $Regimpact_{k,t-1}$, our regulatory variable, is an index that ranges from 0 (low impact of regulation in downstream sectors) to 1 (high impact).[16] Hence, we expect a negative coefficient for this variable. Additionally, sectoral, time and region fixed effects are included (α_k , α_t , α_r, respectively) to control for characteristics that are specific to the sector, year and region. Firm size controls are also included ($\sum_{s=1}^{4} \psi_i D_i$). All regressions use robust standard errors to control for heteroskedasticity.

To assess the potential heterogeneous effects across firm productivity levels and sectors, we extend [2] by interacting the reform variable with a dummy, $Dfront$ (which is one for firms at the sectoral technological frontier and 0 otherwise), and separately for each sector (with and without the interaction variable).

The impact on productivity may be driven by an intensive (i.e., changes in the TFP of firms in the market) or an extensive margin (i.e., exit of firms with lower TFP). We investigate this mechanism through the probit equation [3]:

$$Exit_{i,k,t} = \beta_0 + \beta_1 Regimpact * TFP_{i,k,t-1} + \beta_2 Regimpact_{i,k,t-1} + \beta_3 TFP_{i,k,t-1} + \varepsilon_{i,k,t} \quad [3]$$

Where $Exit_{i,k,t}$ is equal to 1 when a firm exits the market and 0 otherwise, $TFP_{i,k,t-1}$ stands for the level of productivity, and $Regimpact_{i,k,t-1}$ is defined as in [2]. If reforms potentiate the exit

[15] For more detailed information on how this variable is constructed, please refer to Section 4.2.

[16] The index may increase because the downstream sector relies more heavily on regulated upstream sectors or because upstream regulation is tightened.

of low productivity firms, the coefficient of the interaction term should be negative. The coefficient of $Regimpact_{i,k,t-1}$ is also expected to be negative, as a higher value represents a higher impact of regulation in upstream sectors. $TFP_{i,k,t-1}$ should also have a negative coefficient, because more productive firms are more likely to survive. We cluster standard errors at the sector level.

Finally, we apply a difference in differences (*DiD*) approach to evaluate whether the firms in the downstream sectors that benefit the most from reforms (*treated group*) are more resilient to the 2011 crisis. We expect their productivity levels to be less affected by the 2011 crisis, as compared to the *control* group (firms which are less affected by reforms).

Given that, up to 2011, the most important reforms tackled electricity and gas (Figure 2), we focus on these two upstream sectors to create the *treatment* and *control* groups. The *treated* sectors use electricity and gas more intensively, i.e. belong to the 70th sectoral percentile, while the *control* sectors use them less intensely (30th sectoral percentile of gas and electricity usage).[17] To build the sectoral intensities, we use the OECD input-output matrix for the Portuguese economy, between 2004 and 2011. Importantly, we define the *treated* and *control* at the sectoral level, but we then implement a firm-level analysis. This is because we do not have firm-level data on the usage of these two inputs.[18]

We thus estimate the following equation:

$$TFP_{i,k,t} = \alpha_0 + \alpha_1 T_k + \alpha_2 S_t + \alpha_3 T_k * S_t + \varepsilon_{i,k,t} \qquad [4]$$

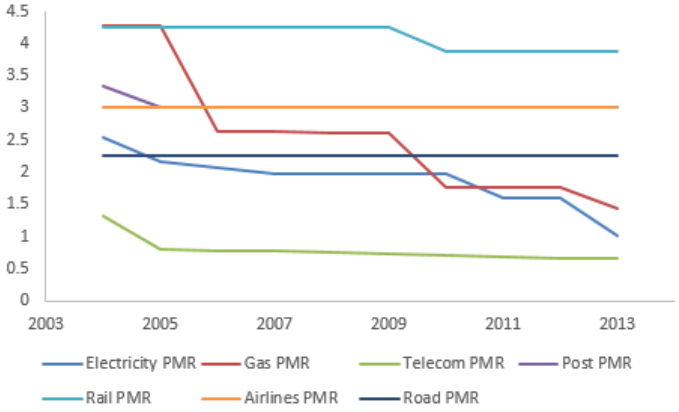
The dependent variable is the level of Total Factor Productivity; T_k is the *treatment* dummy, i.e., it indicates firms in *treated* sectors; S_t is time dummy that turns one from 2011 onwards, while

[17] *Treated* group sectors (70th percentile): Electricity, gas and water supply; Other non-metallic mineral products; Mining and quarrying; Basic metals; Hotels and Restaurants; Agriculture, hunting, forestry and fishing; Pulp, paper, paper products, printing and publishing and Rubber and plastics products; *control* group sectors (30th percentile): Post and telecommunications; Electrical machinery and apparatus, nec; R&D and other business activities; Construction; Motor vehicles, trailers and semi-trailers; Computer, Electronic and optical equipment; Renting of machinery and equipment and Coke, refined petroleum products and nuclear fuel.

[18] Ideally, one would prefer to use firm-level intensities, but this information is not available in our firm-level database.

$T_k * S_t$ is the *DiD* term, that we expect to have a positive coefficient, implying that the *treated* group reacts better to a negative shock, registering a lower decrease in TFP as compared to the *control* group.

Figure 2 – Product market regulation in network industries in Portugal



Source: OECD, Product Market Regulation Database for the years 2004-2013.

5 Empirical Results and Robustness Checks

5.1 Impact on Productivity

We start by estimating [2] to analyse the effects of upstream regulation on firm productivity. The results, presented in Table 4, indicate the presence of short-run costs, as reforms are curbing productivity one year after their implementation. To assess the validity of our results, we conduct several robustness tests. In this regression, we replace our reform indicator with the *narrow* version. As argued by Égert and Wanner (2016), while the *wide* indicator is more suitable for cross-country or cross-sector studies, the *narrow* indicator is better suited for time-series analysis (as only the network indicator has an annual frequency). Furthermore, we test the regression with Labour Productivity, instead of using TFP. Overall, the results are qualitatively the same.

Table 4 - The Impact of Product Market Reforms

Variable	ΔTFP	ΔTFP	ΔLP
ΔFrontier	0.99***	0.99***	4.45***
	(0.02)	(0.02)	(0.09)
DTF	0.6***	0.6***	0.51***
	(0)	(0)	(0)
Regimpact (wide)	0.07***	-	0.08***
	(0.01)		(0.02)
Regimpact (narrow)	-	0.13**	-
		(0.07)	
Small Firm	0.16***	0.16***	0.12***
	(0)	(0)	(0)
Medium Firm	0.30***	0.30***	0.29***
	(0)	(0)	(0.01)
Large Firm	0.43***	0.43***	0.52***
	(0.01)	(0.01)	(0.02)
Sectoral Fixed Effects	YES	YES	YES
Region Fixed Effects	YES	YES	YES
Time Fixed Effects	YES	YES	YES
Constant	-0.61***	-0.61***	-0.8***
	(0)	(0)	(0)
N	1,680,539	1,680,539	1,846,810
R^2	36%	36%	35%

Legend: * p<.1; ** p<.05; *** p<.01
Source: Author's own computations using IES and OECD data for the years 2004-2014.

It is thus important to understand if these costs are broad-based, affecting different firms and sectors equally, or if we face heterogeneous effects.

5.2 Heterogenous Effects

In this section, we explore heterogeneous effects across firms with different productivity and in different sectors. We start by extending equation [2] with an interaction variable (as described in the methodology section), and show that frontier firms are actually gaining from a less stringent regulatory framework in the intermediate sectors one year after the reforms, while laggards are losing (Table 5). However, productivity spillovers from frontier firms are positive, both in terms

of pass-through and catching-up, at least partially compensating for the negative direct effects on laggard firms. These results may be explained by the fact that frontier firms are better equipped to deal with competitive pressures and to grasp the benefits of higher competition in upstream sectors, by using the additional profit margin to reduce prices. Laggards have more compressed profit margins and thus have less scope to do so. The results using the *narrow* indicator and using LP are qualitatively in line with our core estimations, proving that our results are robust.

Table 5 - The Impact of Product Market Reforms

Variable	**ΔTFP**	**ΔTFP**	**ΔLP**
ΔFrontier	1.08***	1.08***	5.17***
	(0.02)	(0.02)	(0.09)
DTF	0.65***	0.65***	0.59***
	(0)	(0)	(0)
Regimpact (wide)	0.14***	-	0.17***
	(0.01)		(0.02)
Regimpact (narrow)	-	0.32***	-
		(0.06)	
DummyFrontier	0.86***	0.78***	1.23***
	(0)	(0)	(0.01)
DummyFrontier*Regimpact (wide)	-0.73***	-	-1.04***
	(0.02)		(0.02)
DummyFrontier*Regimpact (narrow)	-	-0.94***	-
		(0.02)	
Small Firm	0.15	0.15	0.10
	(0)	(0)	(0)
Medium Firm	0.23	0.23	0.20
	(0)	(0)	(0.01)
Large Firm	0.28	0.28	0.30
	(0.11)	(0.01)	(0.02)
Sectoral Fixed Effects	YES	YES	YES
Region Fixed Effects	YES	YES	YES
Time Fixed Effects	YES	YES	YES
Constant	-0.75***	-0.75***	-1.05***
	(0)	(0.01)	(0.01)
N	1,680,539	1,680,539	1,846,810
R^2	43%	43%	42%

Legend: * p<.1; ** p<.05; *** p<.01

Source: Author's own computations using IES and OECD data for the years 2004-2014.

We then estimate equation [2] by sector. Table 6 presents the main results for the different sectors.

Table 6 - The Impact of Product Market Reforms - By Sector

Variable				N	R^2
ΔTFP	**ΔFrontier**	**DTF**	**Regimpact**		
Agriculture, hunting, forestry and fishing	1.75***	0.52***	-1.03***	64,059	41%
Mining and quarrying	-1.45***	0.52***	4.11***	6,577	29%
Food products, beverages and tobacco	-4.01***	0.53***	1.86***	50,122	36%
Wood and products of wood and cork	-2.91***	0.54***	-0.30	23,500	29%
Pulp, paper, paper products, printing and publishing	-0.84***	0.5***	3.13***	21,024	50%
Coke, refined petroleum products and nuclear fuel	2.14	0.59***	2.27	1,410	37%
Chemicals and chemical products	-1.66	0.4***	4.22***	3,813	21%
Rubber and plastics products	1.66***	0.5***	2.05***	8,092	31%
Other non-metallic mineral products	4.25***	0.43***	5.4***	22,910	22%
Textiles, textile products, leather and footwear	-0.32***	0.53***	1.51***	72,709	26%
Basic metals	-9.57***	0.39***	-1.31	2,245	28%
Fabricated metal products except machinery and equipment	-11.51***	0.59***	-3.1***	49,580	34%
Machinery and equipment n.e.c	-3.64***	0.52***	1.5***	10,217	29%
Motor vehicles, trailers and semi-trailers	4.92***	0.48***	5***	3,705	29%
Other transport equipment	-4.30	0.62***	2.14	1,292	43%
Electricity, gas and water supply	0.54	0.57***	0.49	2,906	51%
Construction	-5.37***	0.74***	5.53***	302,312	42%
Transport and storage	-9.02***	0.55***	-1.39***	153,744	27%
Post and telecommunications	0.35	0.72***	2.49***	2,009	50%
Real estate activities	-11.62***	0.69***	-34.86***	67,638	45%
Office, accounting and computing machinery	-1.93	0.06	-16.86	119	13%
Electrical machinery and apparatus n.e.c	0.10	0.6***	1.24	2,542	40%
Radio, television and communication equipment	1.42	0.42***	-9.36	198	35%
Medical, precision and optical instruments	-0.06	0.64***	0.00	6,677	40%
Manufacturing n.e.c; recycling	-5.76***	0.56***	2.83***	21,758	32%
Wholesale and retail trade, repairs	-8.4***	0.46***	0.08***	429,587	29%
Hotels and restaurants	-4.04***	0.55***	-4.34***	217,696	34%
Renting of machinery and equipment	-1.54***	0.53***	15.12***	1,633	34%
Computer and related activities	-0.95**	0.63***	5.15***	30,667	40%
Other Business Activities	12.26***	0.59***	-10.87***	95,321	34%
Research and Development	10.87	0.58***	69.81	1,770	41%

Legend: * p<.1; ** p<.05; *** p<.01
Source: Author's own computations using IES and OECD data for the years 2004-2014.

We show that while some sectors are facing short-term costs, some others, namely Agriculture, hunting, forestry and fishing, Other Business Activities, Real estate activities, Hotels &

Restaurants, Fabricated metal products except machinery and equipment, and Transport and storage, have increased productivity growth already one year after the reforms. The same regression using the *narrow* version of the reform indicator, using LP instead of TFP, and with the distinction of the effect on frontier and laggard firms, is available in tables A1 to A5 in the annexes. Overall, the results are qualitatively the same, with some exceptions for specific sectors.

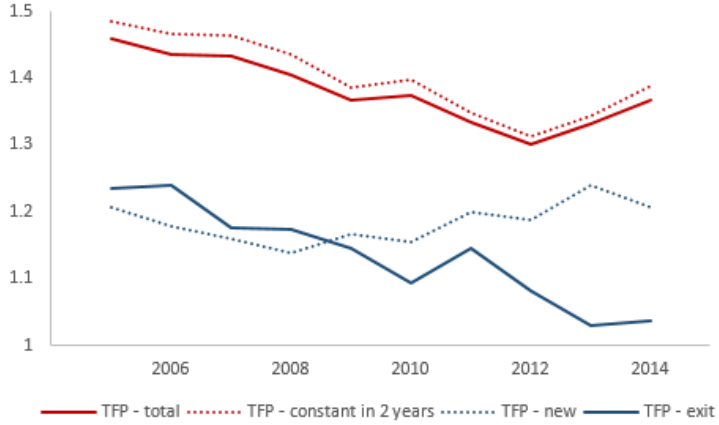
5.4 Improved Resource Allocation and Resilience

We now provide evidence in favour of two possible mechanisms for the effects of upstream reforms on downstream TFP: a better resource allocation, potentiating the exit of lower productivity firms; and a more resilient economy, better equipped to deal with downturns.

5.4.1 Improved Resource Allocation

Figure 3 shows the changing pattern of firm entry and exit in the last decade. While up to 2008 the firms exiting the market had higher productivity than those entering, from 2009 the pattern was reversed. In this section we investigate whether this is related with product market reforms.

Figure 3 – TFP by status of firm: incumbents, new and exit firms



Source: Authors' own calculations. using IES data for the years 2004-2014. N= 2.892.449

By estimating a probit model on the probability of exiting the market (as defined in equation [3]), we show that low productivity firms are more prone to exit the market but that deregulation in

upstream sectors *per se* does not foster firm exit (Table 7); however, the coefficient of the interaction between productivity and the reform variable is negative, meaning that reforms are, as expected, increasing the exit rates for low productivity firms. Following the aforementioned procedure to test the robustness of our calculations, the same equation was estimated using the *narrow* version of the reform indicator, and using LP instead of TFP (Table 7). In spite of punctual differences for some variables that change signs, for our relevant variable, the interaction term, remains negative and significant for all type of regressions.

Table 7 - Probability of Exiting (Probit)

Pr(Exit)	**Coef**	**Coef**	**Coef**
Regimpact (wide)	-0.14	-	4.59***
	(0.28)		(1.42)
Regimpact (narrow)	-	0.09	-
		(0.15)	
lnTFP	-0.13**	-0.14***	-
	(0.04)	(0.03)	
lnLP	-	-	-0.11**
			(0.06)
Regimpact (wide)*lnTFP	-0.2*	-	-
	(0.11)		
Regimpact (narrow)*lnTFP	-	-0.8***	-
		(0.2)	
Regimpact (wide)*lnLP	-	-	-0.51***
			(0.15)
Constant	-1.03**	-1.04***	0.02
	(0.05)	(0.05)	(0.5)
N	1,678,664	1,678,664	1,847,730
Pseudo R^2	1%	2%	5%

(Standard Errors adjusted for clusters in sector)

Legend: * p<.1; ** p<.05; *** p<.01

Source: Author's own computations using IES and OECD data for the years 2004-2014.

In Figure 4 we report the marginal effect of the interaction variable varying TFP, with regulation set at its maximum and minimum, and varying regulation. In Panel 4A, we show that the lower the level of productivity, the higher the impact of regulation on the exit probability. Similarly, by comparing two firms with different productivity levels (Panel 4B), one highly productive and the

other less so, we again show that the difference between their exit probability is much higher in less rigid regulatory environments.

Figure 4 – Predictive Margins

Figure 4A – Predictive Margins (Fixing Regimpact)

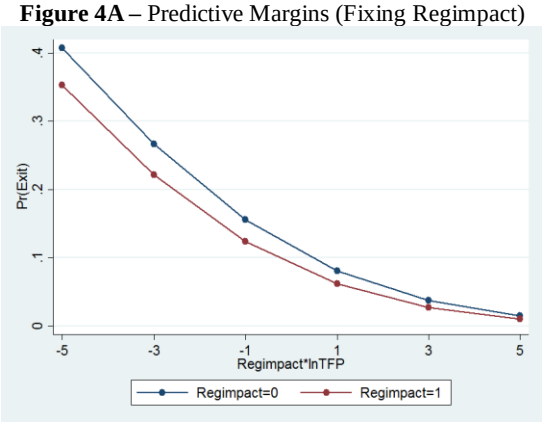
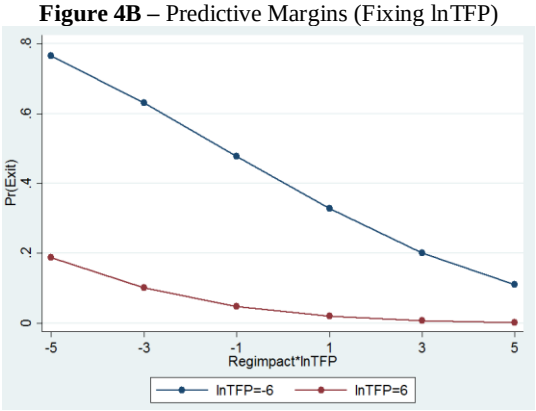


Figure 4B – Predictive Margins (Fixing lnTFP)

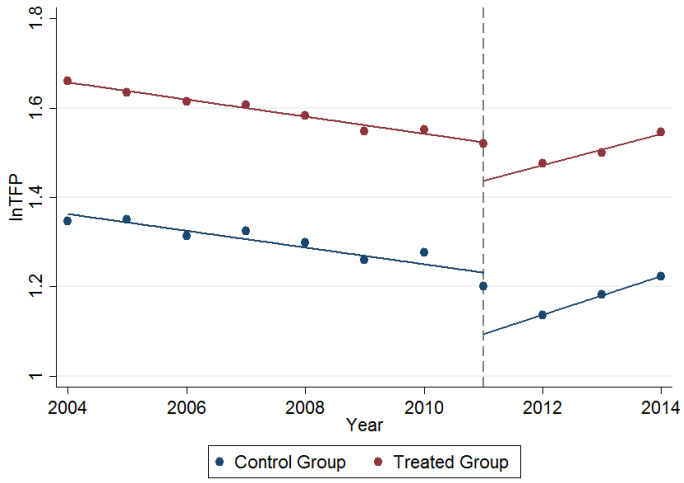


Source: Author's own calculations using IES and OECD data for the years 2004-2014

5.4.2 Improved Resilience

We now use a difference in differences estimation to assess if firms in sectors most affected by reforms (*treated group*) were better equipped to face the 2011 economic crisis, as suggested by the preliminary evidence in Figure 5.

Figure 5 – Mean TFP levels for *treated* and *control* groups



Source: Author's own calculations using IES data for the years 2004-2014. N= 1,373,056.
Note: This graph was produced by using Binscatter command in Stata. This procedure allows us to observe the average values by year and group for different periods of time, in this case, years.[19]

[19] The treated sectors use electricity and gas more intensively, while the control sectors use them less intensely.

The results in Table 8 confirm that firms in *treated* sectors are more resilient to negative shocks when compared to the *control* group, i.e. in the face of the 2011 crisis their TFP decreased less. Ideally, we should have a placebo group, running the same *DiD* in a period with a crisis but no deregulation policies. Unfortunately, this is not possible, as our dataset only covers the period starting in 2004. In any case, to assess the robustness of the results, we compute the same regression without the electricity and gas sectors. These sectors could potentially bias our results, as they were directly affected by the reforms (on top of the usual downstream effects affecting all sectors). The results remain unchanged, as we continue to see more resilience in the *treated* group. The same procedure when applied using LP in Table 9, however, displays a statistically insignificant coefficient.

Table 8 - Difference in Differences Estimation Results

lnTFP	**Complete**	**Without Electicity and Gas Sectors**
Time	-0.12***	-0.12***
	(0)	(0)
Treated	0.29**	0.29**
	(0.11)	(0.11)
DiD	0.04**	0.04**
	(0.01)	(0.01)
Cons	1.31***	1.31***
	(0.01)	(0.01)
Controls	YES	YES
N	1,373,056	1,373,056
R^2	3%	3%

Table 9 - Difference in Differences Estimation Results

lnLP	**Complete**
Time	-0.29***
	(0.01)
Treated	0.12
	(0.2)
DiD	0.11***
	(0.02)
Cons	10.6***
	(0.02)
Controls	YES
N	1,490,905
R^2	1%

(Standard Errors adjusted for clusters in sector)
Legend: * p<.1; ** p<.05; *** p<.01
Source: Author's own calculations.
Note: The controls are: Output, Operational Costs, Cost of Employees, and Number of Employes

6 Conclusion

In recent years, Portugal implemented a large number of structural reforms. Quantitative information on their effects in the economy is crucial for policy makers, as it allows fine-tuning past reform efforts and better design future reforms. Taking stock of what was achieved so far is crucial to define the way forward.

In this study we focus on the effects of product market reforms, given their relevance in the Portuguese reform agenda in recent years, their large potential pay-offs and the usual resistance to reform, particularly acute in this area (with concentrated costs and diffuse benefits). In particular, we assess the short-run effects of product market reforms in upstream sectors on the firm-level productivity of downstream sectors, evaluating also the impact on the allocation of resources and on the resilience to adverse shocks. Short-term effects are particularly relevant given their role on the political economy of the process.

Relying on firm-level data for Portugal, covering the period between 2004 and 2014, we show that the short-run impact of reform on firm-level productivity is positive for the most productive firms (those belonging to the sectoral technological frontier), who are able to leverage on the increase competitiveness in the upstream sectors. [20] But the impact is negative for the other, less productive firms. Indeed, we show that the exit of the least productive is potentiated by the reform process. Still, for those that stay, there are second round effects from the gains at the frontier, as we find evidence of positive pass-through and catching-up mechanisms. In addition, our results corroborate existing studies that show that effects across sectors are differentiated: while some sectors are benefiting from upstream deregulation already after one year, some others see their productivity growth curbed. Finally, we find evidence that reforms increase firms' resilience to negative shocks.

[20] We assess the effects of the reforms implemented up to 2013. Reform efforts in more recent years can only be evaluated when more data becomes available.

Going forward, it would be important to enrich our results in a number of ways.

The results provide a partial picture of the effects of the reforms, as they focus solely on the short-run. We opted for this time horizon because some of the reforms are very recent and our available time-series is not very long. In any case, our assessment of the increased resilience to adverse shocks already points to these positive long-term effects. As more data becomes available, it will be possible to evaluate the longer-term effects of reforms on firms' productivity.

In addition, it would be informative to better understand the causes of the short-term costs. Following the literature, we could enlarge our analysis by accounting for the effect of the cycle. A preliminary attempt with the existing data shows that the effects of reforms before the financial and economic crisis are positive and only become negative during the downturn. However, a robust assessment would need to rely on a longer time-series. We could also explore the role of the initial framework conditions and the interactions with other reform areas as existing literature highlights their relevance, in particular in the short-run.

Finally, and while Total Factor Productivity is a key determinant of growth, it is also important to assess the impact of product market reforms on labour utilisation and in particular on employment. Equity considerations are also of key importance.

7 References

[1] Adhikari, B., Duval, R., Hu, B. and Loungani, P. 2016. *"Can reform waves turn the tide? Some case studies using the synthetic Control Method"* IMF Working Paper 16/171.

[2] Andrés, J., Arce, O. and Thomas, C. 2014. *"Structural Reforms in a Debt Overhang*" Banco de España Documentos de Trabajo No. 1421.

[3] Amador, J. and Soares, A. 2014. *"Competition in the Portuguese Economy. Estimated Price-Cost Margins Under Imperfect Labour Markets"* Working Papers Series of the European Central Bank, No. 1751.

[4] Arnold, J. and Barbosa, N. 2015. *"Structural policies and productivity: evidence from Portuguese firms"* OECD Economics Department Working Paper No. 1259. OECD publishing. Paris.

[5] Arpaia, A., Roeger, W., Varga, J., Veld, J., Grilo,I. and Wobst, P. 2007. *"Quantitative Assessment of Structural Reforms: Modelling the Lisbon Strategy"* European Economy Economic Papers No. 282. European Commission. Brussels.

[6] Barnes, S., Bouis, R., Briard, P., Dougherty, S. and Eris, M. 2013. "*The GDP impact of reform: a simple simulation framework*" OECD Economics Department Working Papers No. 834. OECD publishing. Paris.

[7] Barone, G. and F. Cingano. 2011, *"Service Regulation and Growth: Evidence from OECD Countries*" The Economic Journal, Vol. 121, No. 555.

[8] Bouis, R., Causa, O., Demmou, L., Duval, R. and Zdzienicka, A. 2012. *"The short-term effects of structural reforms: an empirical Analysis*" OECD Economics Department Working Paper No. 949. March 2012.

[9] Bouis, R. and Duval, R. 2011. "*Raising potential growth after the crisis: a quantitative assessment of the potential gains from various structural reforms in the OECD area and beyond"* OECD Economics Department Working Paper No. 835. OECD publishing. Paris.

[10] Bourlès, R., Cette, G., Lopez, J., Mairesse, J., Giuseppe Nicoletti, G. 2013. "*Do product market regulations in upstream sectors curb productivity growth? Panel data evidence for OECD countries*" Economics department working papers No. 791. OECD publishing. Paris.

[11] Cacciatore, M., Duval, R., Fiori, G. and Ghironi, F. 2016. Short-Term Pain for Long-Term Gain: Market Deregulation and Monetary Policy in Small Open Economies. Journal of International Money Money and Finance, Vol. 68.

[12] Cacciatori, M. and Fiori, G. 2016. "*The macroeconomic effects of goods and labor markets deregulation*" Review of Economic Dynamics 20 (2016) 1-24.

[13] Cincera, M. and Galgau, O. 2005. "*Impact of Market Entry and Exit on EU Productivity and Growth Performance*" European Commission Economic Papers No. 222.

[14] Dabla-Norris, E., Guo, S., Haksar, V., Kim, M., Kochhar, K., Wiseman, K. and Zdzienicka, A. 2015. "*The New Normal: A Sector-Level Perspective on Productivity Trends in Advanced Economies"* Staff Discussion Notes No. 15/3.

[15] Duval, R., J. Elmeskov and L. Vogel (2007), *"Structural Policies and Economic Resilience to Shocks"*, OECD Economics Department Working Papers, No. 567, OECD Publishing, Paris.

[16] Égert, B. and P. Gal. 2016. *"The Quantification of Structural Reforms: A New Framework"*, OECD Economics Department Working Paper No. 1354. OECD publishing. Paris.

[17] Égert, B. and I. Wanner (2016), "*Regulations in services sectors and their impact on downstream industries: The OECD 2013 Regimpact Indicator*", OECD Economics Department Working Papers, No. 1303, OECD Publishing, Paris.

[18] Eggertsson, G., Ferrero, A. and Raffo, A. 2013. "*Can Structural Reforms Help Europe?"* International Finance Discussion Papers No.1092.

[19] Ernst, Gong and Semmler. 2007. *"Resilience, Consumption smoothing and structural policies"*, Paper prepared for the OECD Workshop *"Structural reforms and economic resilience: evidence and policy implications"*.

[20] Everaert, L. and Schule, W. 2008. "*Why It Pays to Synchronize Structural Reforms in the Euro Area Across Markets and Countries*" IMF Staff Papers Vol.55 No.2. International Monetary Fund.

[21] Folque, L. 2016. *"Estimation of price-cost margins for Portuguese firms: a contribution for the assessment and monitoring of product market competition"*. Master's thesis, Nova School of Business and Economics.

[22] Forlani, E., 2012, "*Competition in Services and Efficiency of Manufacturing Firms: Does 'Liberalization' Matter?*" LICOS Discussion Paper No. 311/2012 (Katholieke Universiteit Leuven).

[23] Foster, L., J. Haltiwanger, and C. Krizan (2001) "*Aggregate Productivity Growth: Lessons from Microeconomic Evidence*" pp. 303–372. University of Chicago Press.

[24] Gal, P. and Hijzen, A. 2016. "*The short-term impact of product market reforms: A cross-country firm-level analysis*" IMF Working Paper 16/116.

[25] IMF. 2015. "*Structural reforms and macroeconomic performance: initial considerations for the fund"* Staff report, November 2015.

[25] IMF. 2016. "*Time for a supply-side boost? Macroeconomic effects of labor and product*" World Economic Outlook – too slow for too long?. Chapter 3. April 2016.

[26] Lanau, S. and Topalova, P. 2016. The Impact of Product Market Reforms on Firm Productivity in Italy. IMF Working Paper 16/119.

[27] Levinsohn, J. and Petrin, A. (2003), "*Estimating Production Functions Using Inputs to Control for Unobservables*", The Review of Economic Studies, Vol.70, No.2, pp.317-341.

[28] Nicoletti, G. and Scarpetta, S. 2003. Regulation, productivity and growth. OECD Economics Department Working Paper 347. OECD publishing. Paris.

[29] OECD. 2015. Italy Structural reforms: impact on growth and employment.

[30] Pelkmans,J., Montoya L. and Maravalle, A. 2008. "*How product market reforms lubricate shock adjustment in the euro area*" European Economy Economic Papers No. 341, European Commission, Brussels.

[31] Santos, S., Gouveia, A. and Gonçalves,I. 2017. *"The short-term impact of structural reforms on productivity growth: beyond direct effects"* GPEARI – Ministério das Finanças.

[32] Schiantarelli, F. 2005. "*Product Market Regulation and Macroeconomic Performance: A Review of Cross Country Evidence*" IZA DP No.1791.

[33] Restuccia,D. and Rogerson,R. 2007. "*Policy Distortions and Aggregate Productivity with Heterogeneous Plants*". NBER Working Paper Series. Working Paper No. 13018.