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Assessment of the Influence of Feed-In Tariffs on the Profitability of European Photovoltaic Companies

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Abstract: Feed-in tariff policies have been the most common and effective tool contributing towards the important growth in photovoltaic solar energy in Europe. The purpose of this study is to analyze their influence on the economic profitability of photovoltaic companies operating in the most characteristic regions, Germany, Italy, France and Spain in the period 2008–2012. Variables characterizing these companies are also included. Regarding the method, a static linear panel data model is used. The results show how feed-in tariffs (FITs henceforth) have in fact had a significant positive influence on the economic profitability of these companies. In addition, the findings suggest that the expansion of these companies in terms of assets implies increased competition in the sector, positively influencing their profitability given the economies of scale generated. Moreover, contrary to expectations, photovoltaic companies with the highest leverage ratios are those with the largest return on investment in the analyzed period, what could be a consequence of their higher possibilities of investing the obtained external funds on PV technology.

Keywords: feed-in tariffs; panel data; photovoltaic; solar energy

1. Introduction

In recent years, a large number of policies have been approved throughout the world with the aim of encouraging the use of energy from renewable sources (REs henceforth). One reason for this is the need to reduce emissions of pollutant gases [1], an objective initially pursued with the approval of the Kyoto Protocol in 1998, which committed the main industrialized countries to reduction of what are called greenhouse gases. More specifically, in the European framework, this fact was reinforced by the approval in 2001 of Directive 2001/77/EC, updated by Directive 2009/28/EC, creating a common framework in the promotion of RE for countries belonging to the European Union. According to Dusonchet and Telaretti [2] (p. 3297), the most recent update of this directive had the following aims ('... targets are based on a flat rate increase in the share of renewables weighted by GDP and modulated to take account of earlier development of these resources' [1]): 'the reduction of at least 20% of greenhouse gases, from 1990; the production from Renewable Energy Sources (RES) of 20% of internal energy consumption; and the use of biofuels to cover at least 10% of the energy consumption for transport.'

Another reason is that encouragement of RE would allow dependence on fossil fuels from other countries to be reduced [1]. Along these lines, Lesser and Su [3] go further, declaring that policies aimed at this objective would not only allow a reduction in energy dependence but would also contribute towards creating a much more diversified energy mix as well as reducing exposure to fuel price fluctuations. Furthermore, REs also allow increased innovation and the development of industrial capabilities, as well as benefits for the regional and national economy [4].

The types of policies intended to encourage REs are highly diverse (Table 1). Their aim being to enable reduction in the costs of technologies allowing this type of energy to be obtained and to facilitate their greater market penetration [5], each having strengths for producers of this kind of energy and society in general, and also showing weaknesses depending on how they are incorporated in each country [6].

Table 1. Types of policies for the promotion of renewable energies.

		Direct		Indirect
		Price-Driven	**Quantity-Driven**	
Regulatory	Investment focused	Investment incentives Tax credits Low interest/soft loans	Tendering system for investment grant	Environmental taxes Simplification of authorization procedures Connection charges, balancing costs
	Generation based	(Fixed) FITs Fixed premium system	Tendering system for long-term contracts Tradable green certificate system	
Voluntary	Investment focused	Shareholder programs Contribution programs		Voluntary agreements
	Generation based	Green tariffs		

Source: Haas et al. [7].

However despite the existence of different types of policy, feed-in tariff (FIT) systems are the most common tool in REs promotion in Europe; specifically, for the specific period between 2000 and 2012, the number of European countries applying FITs was increased, from 9–24 [8]. Furthermore, these policies are an effective mechanism for the REs development; in this line, Haas et al. [7] hold that compared with regions using tradable green certificates or other incentives, countries using FITs as a means of developing renewable energies obtain greater efficiency. On the other hand, these policies induce innovation on more costly energy technologies, such as solar power [5].

With reference to the importance of the FITs in the development of photovoltaic solar energy, besides producing a significant development of REs in general, FITs have been the policy most used to promote photovoltaic energy in Europe. According to the report published by the IEA [9], these policies represent 61% of the total subsidies dedicated to photovoltaic in 2012 (Figure 1), with a proportion in historical terms of 72% up to that year (Figure 2). Also, FITs have been the first policy employed in the development of this type of energy [6,10,11].

Moreover, these policies have contributed to significant growth of photovoltaic energy in recent years. Thus, Ragwitz et al. [8] argue that these policies have allowed important growth in photovoltaic plants, the leading players being Germany and Spain, also facilitating the development of previously unimportant markets such as Italy, France, Portugal, the Czech Republic and Slovenia, and more recently the United Kingdom. In addition, some authors [3,12] hold that FITs are the most effective policies for the production of this type of energy, so enabling photovoltaic technology to have reached a constant learning rate [13]. Furthermore, Campoccia et al. [6] hold that currently, the photovoltaic market has a great potential in the contribution of REs to energy production (Table 2); specifically the data provided by the EPIA's 2014 report [14] show how photovoltaic energy had over 10 GW connected to the grid at the end of 2013, contributing approximately 3% of European energy demand.

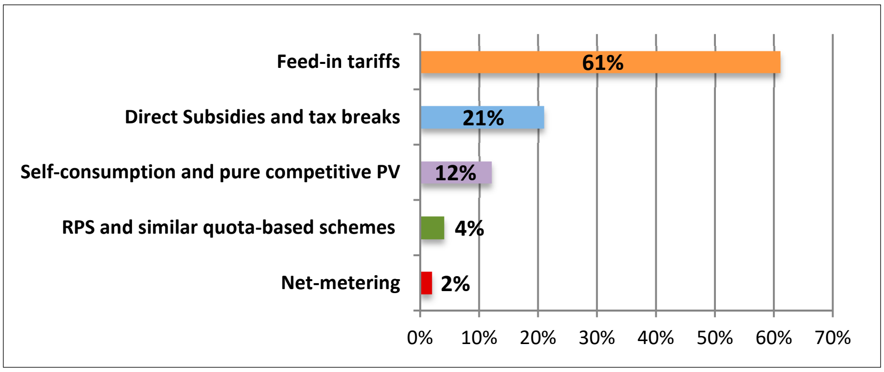

Figure 1. Market incentives for photovoltaic in 2012. Source: Author's elaboration from IEA [9].

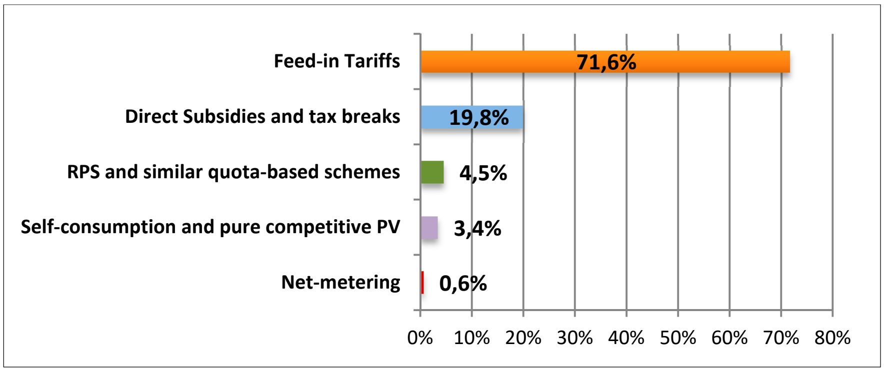

Figure 2. Historical market incentives for photovoltaic until 2012. Source: Author's elaboration from IEA [9].

Table 2. Gross production of energy from renewable sources in European Union 28 (GWh).

Renewable Source	Year 2000	Year 2013
Hydro	386,303	402,154
Wind	22,254	235,012
Solar photovoltaic	118	80,867
Solar thermal	0	4395
Tide, Wave and Ocean	507	420
Solid biofuels excluding charcoal	20,309	81,501
Biogases	6418	52,837
Municipal waste (renewable)	7332	1864
Biodiesels	0	25
Other liquid Biofuels	0	4259
Geothermal	4785	5936

Source: Author's elaboration from Eurostat.

Regarding the types of FITs systems, in general, they can be classified as a fixed FITs and premium FITs, independent or not, respectively, of electricity market prices. Each type of policy has various advantages and disadvantages (see Couture et al. [15] for further analysis). However, fixed FITs have been the policy preferred by European countries to support REs compared with premium FITs [15], although Ragwitz et al. [8] assert that the use of the latter has notably increased in recent years (Czech Republic, Denmark, Estonia, Finland, Germany, Italy, the Netherlands, Slovakia, Slovenia and Spain), whether as the main modality or in combination with other policies (Czech Republic, Germany, Slovenia and Spain).

Fixed FITs guarantee payment of a particular tariff, the value of which is independent of the electricity market price, generally out of it, for a particular period (about 20 years). As a consequence of this advantage, they make investors feel much more secure [3,16,17] because they reduce the risks associated with these investments [18,19], by giving stable cash flows in the future [20]. In addition, more targeted subsidies, such as FITs, are needed to induce innovation on more costly energy technologies, such as solar power [5]. More specifically, García-Álvarez et al. [21] analyze the success of these incentives for German and Spanish markets, finding that in both markets FITs enables essential development of REs, causing the increased employment, RDI and GDP, as well as reduced emission of pollutant gases. The essential stability to these incentives has allowed the creation of many jobs and economic opportunities in new sectors [22].

However, some of these policies' inherent disadvantages have also been shown. On the one hand, the fact that these tariffs are maintained for long periods of time may affect system costs, making them too high [23,24]. Along with this line, Lesser and Su [3] maintain that this could cause tariffs to deviate from market prices and, if high, could increase electricity prices, while if they were low, would not achieve the objectives set. On the other hand, the study carried out by Dusonchet, and Telaretti [2] shows how the effectiveness associated with FITs may be limited because sometimes the tariffs are established for short periods of time or the procedures required by the administration are too restrictive.

Ayoub and Yuji [16] (p. 194) list the main reasons explaining the success of FITs policies: 'FIT offers long-term security for investors through guaranteed and fixed tariffs for a long periods on a relatively high level (high price per kilowatt hour); the existence of well-built financial subsidy programs; regional investments towards economic and social welfare; technology-specific and location dependent differentiation; stable governmental regulations.'

Premium FITs are those which depend on electricity market prices, guaranteeing a premium (fixed or variable) or overprice above-market prices for renewable energy producers. According to Couture et al. [15], the value of the premium established for these FITs is established so that either (i) environmental and/social costs in renewable energy production or (ii) the costs associated with energy generation by renewable means are taken into account.

The most significant advantage of these incentives is their market orientation [15], because part of the total remuneration obtained by renewable energy generators is the price of electricity on the market [21]; in fact, premium FITs allow the distortions occurring on the electricity market to be reduced, so this modality is preferable to fixed FITs [1]. Additionally, Couture and Cagnon [19] (p. 964) point out that while FITs allow a reduction in investment risk, premium FITs provide an incentive for energy production at times when it is most needed, 'which alleviate peak supply pressures and improve the market integration of RE sources.' In addition, linking the premium obtained to electricity market prices prevents producers from making extraordinary profits [21], which in turn allows system costs not to be increased unnecessarily. Furthermore, the use of premium FITs would be more suitable for less mature technologies, according to the conclusions of the study carried out by Canton and Johannesson [1]. In addition, in the future, this measure could contribute towards improving integration of renewable energies in the electricity market, an increase in the use of this system being observed precisely in recent years [8].

With regard to the disadvantage of the use of premiums, the first is that because of exposure to the fluctuations of market prices increases the risks related to the investment [21]. In addition, there being no guarantee of virtuous also increases these risks [15]. However, compared with market price dependent premium FITs, FITs give investors greater security in terms of the investment [17,19], mainly because of minimization of the risks associated with the investment and the certainty with regard to the cash flow generated [19]. However, being a less efficient system regarding costs, it causes costs per kWh produced to be higher on average than those of FITs [15].

Given this scenario, FITs monitoring is necessary. These support measures require continuous supervision by governments so that they can be adapted correctly in a way that ensures the efficiency of this system and consequently uncontrolled growth of it can be avoided [2]. So 'well-managed FITs have proven effective in stimulating deployment while providing fair but not excessive remuneration to investors (. . .)' [25]. Haas et al. [7], analyzing the different types of policy for stimulation of RE in the European regions, found that good design of these policies does allow development of RE with few implications for society in terms of costs. In addition, they declare that compared with those regions which use tradable green certificates or other incentives, the country is using FITs as an RE development measure of obtaining greater efficacy. Lesser and Su [3] hold that economically efficient FITs would allow renewable energy producers to maximize their production without affecting electricity market prices. Following this argument, Ragwitz et al. [8] indicate that FITs are effective as well as efficient in terms of costs as long as they are well designed, indicating that the best elements put into practice to control this aspect include measures such as gradual tariff reduction (with degressive feed-in tariffs that anticipate technical progress, the profits resulting from technical progress can be shared out more equitably by reducing the total cost borne by the community while granting a certain surplus to producers [26].), the establishment of quotas, use of a staggered tariff or net-metering. Through this last system, producers of renewable energy for self-consumption can discharge the excess energy they do not need into the electricity network, energy demand greater than that generated by the system in question being compensated for in subsequent electricity bills.

However, in some cases, the wrong design of these policies coupled with unwise revising them has led to the adoption of damaging measures to the photovoltaic sector, in some cases clearly retroactive. The report of the EPIA [27] gives details of how measures have been put into practice in certain European countries, including Italy, France and Spain, which are damaging to the photovoltaic market some of these measures being retroactive, moratoria, and unexpected reductions in levels of aid to this sector, causing cancellation of new plant construction projects, as well as investors' insecurity and the loss of numerous jobs.

Regarding the current state of the research field, many authors [2,28–30] have analyzed the profitability of photovoltaic installations in different policy scenarios and with different economic and financing conditions, through well-known methods such as net present value (NPV) and internal rate of return (IRR). However, it only found the study carried out by Jaraité and Kazukauskas [31] that more examines explicitly the profitability of electricity sector companies, regardless of the technology used, in markets applying tradable green certificates compared with those applying FITs, for the period 2002–2010.

With reference to the purpose of the work and its significance, this study contributes to enlarging the existing literature, because it is concentrated exclusively on photovoltaic companies in the way of allowing the influence of FITs on their economic profitability (ROI) to be analyzed in greater detail, this influence is expected to be positive, as is deduced from the aforementioned literature, also taking the characteristics of each of the companies comprising the sample into account.

On the other hand, the countries examined are those which are most representative of the European photovoltaic market: Germany, Italy, Spain and France; moreover, these countries have already been the subject of study in numerous studies because of their great importance in the context of the European photovoltaic market. In addition, this study has been conducted for the period 2008–2012. Those four regions and the period studied have been selected for the following reasons: (a) These four countries had high growth rates in this period in terms of installed photovoltaic power (Table 3), with accumulated capacities at the end of 2012 of 35.7, 17.9, 5.3 and 4.7 GW, respectively, which means shares of each market in the total accumulated photovoltaic power in Europe of 46.06, 23.42, 7.42 and 5.77% for the same year (Table 4). Also, subsequent reductions in the photovoltaic market occurred because of important cuts made to FITs; (b) FITs systems have been the prevailing policy in each of these countries for the promotion of photovoltaic solar energy (see Winkel et al., [32] for a more detailed analysis), contributing to a substantial growth in this type of renewable energy, as we have already explained.

Table 3. Evolution of the installed photovoltaic capacity for the regions under study.

	Installed Capacity (MW)						
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Germany	1100	1500	3806	7408	7485	7604	3304
Italy	42	258	717	2321	9284	3759	1448
Spain	560	2511	17	369	372	332	118
France	11	46	219	719	1671	1115	613

Source: Author's elaboration from EPIA [14,27,33,34].

Table 4. Installed photovoltaic capacity and cumulative (MW) in the European countries in 2012.

Country	Installed Capacity	Cumulative Installed Capacity	Country	Installed Capacity	Cumulative Installed Capacity
Austria	175	363	Lithuania	6	6
Belgium	683	2768	Luxembourg	0	30
Bulgaria	843	1010	Malta	4	16
Croatia	0	0	The Netherlands	195	360
Cyprus	7	17	Norway	0	0
Czech Republic	116	2087	Poland	4	7
Denmark	316	332	Portugal	70	242
Estonia	0	0	Romania	46	51
Finland	0	11	Slovakia	15	523
France	1115	4060	Slovenia	122	201
Germany	7604	32411	Spain	332	5221
Greece	912	1536	Sweden	8	22
Hungary	8	12	Switzerland	226	437
Ireland	0	3	Turkey	5	12
Italy	3759	16479	Ukraine	130	326
Latvia	0	1	United Kingdom	925	1829

Source: Author's elaboration from EPIA [14].

2. Materials and Methods

In this section, first, hypothesis and the econometric model used are presented (Section 2.1). Subsequently, the population of photovoltaic companies is determined, for the selection of the final sample (Section 2.2). Finally, the variables used in the model are selected (Section 2.3).

2.1. Hypothesis and Model

In this part, the econometric model developed is determined. The economic profitability of photovoltaic companies will be affected by FITs policies, this influence being different according to the characteristics of the companies, including, therefore, controls representing these characteristics.

It should be mentioned that different individuals may behave differently because of unobservable factors, there existing, therefore, an unobservable heterogeneousness, consequently making OLS (Ordinary least squares) estimation biased and not consistent. This is the reason why a static linear panel data model was estimated. Firstly, a fixed effect model was set up in which the explanatory variables are correlated with the individual effects. Secondly, a model of random effects was built so that there was no such correlation between the explanatory variables of the model and individual effects, which consists of a fixed part and a random part.

This is the static linear panel data model used. The results section provides further explanation about the selection of this model:

$$\mathrm{ROI_{it}} = \alpha + \beta_1 \mathrm{FIT_{it}} + \mathrm{X_{it}}\gamma + \mathrm{u_i} + \varepsilon_{\mathrm{it}} \quad (1)$$

where $\mathrm{ROI_{it}}$ is the economic profitability of company i at time t (dependent variable of the model); $\mathrm{FIT_{it}}$ is the explanatory or independent variable; $\mathrm{X_{it}}$ represents the characteristics of photovoltaic companies;

ε_{it} is the error or brand and disturbance term; and finally, in the random effects model, individual effects are divided into a fixed part and another with random behavior ($\alpha_i = \alpha + u_i$).

2.2. Population and Sample

To select the population, the Amadeus database was searched for companies producing photovoltaic solar energy. First, those which had been assigned the NACE Rev. 2 3511 "electricity production" code. This category includes the operation of electrical power generation facilities including thermal, nuclear, hydroelectric, gas, diesel and renewable sources. However, this study focused only on photovoltaic companies and so selected just those which included terms relating to photovoltaic activity in their company name or description. Those established up to and including 2008 and residing in the regions under analysis (Germany, Italy, France and Spain) were then selected. The final population was a total of 1069 companies, distributed by size (very large, large, medium and small), following the Amadeus database size definitions. The company types in Amadeus as regards size are: (a) Very large, companies meeting at least one of these criteria: operating revenue (turnover) ≥100 m EUR, total assets ≥200 m EUR, number of employees ≥1000, Listed company; (b) Large, companies meeting at least one of these criteria: Operating revenue (turnover) ≥10 m EUR, total assets ≥20 m EUR, number of employees ≥ 50, not related to any companies categorized as very large; (c) medium sized, companies meeting at least one of these criteria: Operating revenue (turnover) ≥1 m EUR, total assets ≥2 m EUR, number of employees ≥15, not related to any companies categorized as large; (d) small, companies not included in any of the above categories. The final sample, selected from the population by stratified sampling with proportional allocation, was 500 solar photovoltaic companies, randomly chosen, distributed by country and company size, maintaining the distribution of the selected initial population (Table 5). We decided to study this number of companies given the data available, despite it being too large to be considered a sample.

Table 5. Final sample and distribution of photovoltaic companies.

		Country				
		Germany	**Italy**	**Spain**	**France**	**Total**
SIZE	**Very large**	2 (0.4%)	2 (0.4%)	3 (0.6%)	1 (0.2%)	8 (1.6%)
	Large	9 (1.8%)	7 (1.4%)	19 (3.8%)	1 (0.2%)	36 (7.2%)
	Medium	11 (2.2%)	1 (0.2)	39 (7.8%)	6 (1.2%)	57 (11.4%)
	Small	14 (2.8%)	4 (0.8%)	352 (70.4%)	29 (5.8%)	399 (79.8%)
	TOTAL	36 (7.2%)	14 (2.8%)	413 (82.6%)	37 (7.4%)	500 (100%)

2.3. Variables Selected

Here the variables used in the study are presented, with their measurements and sources used to obtain the data (Table 6). As we have already pointed out, the purpose is to analyze the influence FITs have had on the financial profitability of companies dedicated to photovoltaic solar power production. Furthermore, variables are included which characterize companies and also help to explain said profitability.

Table 6. Summary of variables used, description, measurement unit and sources.

Variable	Definition-Estimation	Measurement Unit	Source
ROI	Return on investment = Earnings before interests and taxes/Total assets	Ratio	Amadeus

Table 6. *Cont.*

Variable	Definition-Estimation	Measurement Unit	Source
FIT	Feed-in tariff = Average feed-in tariff	€/MWh	CEER (Council of European Energy Regulators) (2011, 2013, 2015) GSE (Energy Services Manager) Del Rio y Mir-Artigues [35]
ASSETS	Total assets (natural logarithm)	Thousands Euro	Amadeus
LIQ	Liquidity ratio = cash/current liabilities	Ratio	Amadeus
LEV	Leverage ratio = (current liabilities + non current liabilities)/shareholder funds	Ratio	Amadeus
AGE	Age of company	Number of years	Amadeus
SECACT	Secondary activity	Dummy variable (constructed) one, if there is a secondary activity; zero, if there is not a secondary activity	Amadeus
COUNTRY 1	Germany	Dummy variables (constructed) one, if the company belongs to Germany; zero, otherwise	Amadeus
COUNTRY 2	Italy	Dummy variables (constructed) one, if the company belongs to Italy; zero, otherwise	Amadeus
COUNTRY 3	France	Dummy variables (constructed) one, if the company belongs to France; zero, otherwise	Amadeus
COUNTRY 4	Spain	Dummy variables (constructed) one, if the company belongs to Spain; zero, otherwise	Amadeus

The model's dependent variable is return on investment ROI_{it}, defined as the ratio between profit before interest and taxes and the company's total assets.

The model's independent or explanatory variable is the FITs, *FIT*, the average incentive received for photovoltaic production in each country (€/MWh), reflecting the efforts of governments when it comes to promoting this type of energy. It is expected that this policy will have a positive, significant effect on the ROI of photovoltaic companies. However, it should be mentioned that the FITs is the same for companies of the same region, because of the difficulty of knowing beforehand the number of facilities, type of technology, production and specific law under which each company adheres to the regime, and consequently, the specific incentive perceived by each photovoltaic project.

With regard to the variables characterizing companies included in the sample, the first included was ASSETS, (it has taken the natural logarithm of total assets to avoid the extreme values of this variable distorting the results obtained, strategy previously used by [31].) because it could have a relationship with the return obtained by companies [31,36]. Therefore, Jaraité and Kazukauskas [31] holds that in companies' growth processes, they can obtain greater profits if they take advantage of economies of scale generated, so the relationship between profit and size would be positive, being negative if diseconomies of scale were obtained [36].

Secondly, the variable liquidity (cash between current liabilities), *LIQ*, indicates a company's ability to meet its most immediate obligations. Thus, a company with high liquidity will be at lower risk of not being able to meet such obligations, while it may also indicate long-term investment opportunities not taken advantage of [26].

The leverage ratio—total liabilities within equity—LEV, is also included. Goddard et al. [36] use a variation of this ratio—non-current liabilities plus loans, within shareholders' funds—and point out that companies with a high leverage ratio, which indicates that outside resources are much higher than own resources, tend to have less liquidity and, consequently fewer opportunities to make important investments, which negatively affects their profitability.

In addition, the variable SECACT, "secondary activity", is included in the model. The reason for this inclusion is that a priori, the influence on companies' profitability should be different if the company exclusively dedicates its activity to photovoltaic production than if it is diversified among other activities. This is a dummy variable with the value one activity and zero otherwise.

The company's AGE is also included in our model because this variable allows companies' years of experience in the market to be monitored [26]. In this sense, companies with more years of experience are expected to have fewer problems in their capacity to go into debt, while younger companies may benefit from more modern and therefore more efficient technologies [26], the latter aspect being a very important factor for the photovoltaic sector specifically. '(...) In technology- and knowledge-based sectors in particular, strategies of innovation and product differentiation may enable profitability to diverge from competitive norms for long [36].

The dummy COUNTRY variables are introduced as control variables given the differences between the four study regions regarding CO_2 emissions, energy dependence, PV capacity and electricity consumption. Table 7 is a summary of descriptive statistics for this variable in the sample. Germany, where the world's first feed-in tariff was introduced in 2000, is the country in the sample with the highest CO_2 emissions and also with the highest PV capacity for the period 2008–2012. In addition, it is one of the countries with the highest electricity consumption for the study period.

Table 7. Summary of descriptive statistics for emissions, consumption, capacity and dependence by country.

Variable: CO_2 Emissions (Metric Tons Per Capita)	Obs	Mean	Std. Dev.	Min	Max
Germany	180	9.922	0.205	9.68	10.28
Italy	70	6.972	0.329	6.77	7.62
France	185	6.008	0.268	5.67	6.35
Spain	2065	6.402	0.515	5.93	7.35
Variable: Energy Dependence (%)	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Germany	180	0.609	0.005	0.616	0.601
Italy	70	0.828	0.022	0.793	0.857
France	185	0.494	0.011	0.48	0.509
Spain	2065	0.773	0.027	0.731	0.813
Variable: PV Capacity (MW)	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Germany	180	5560.6	2491.232	1500	7604
Italy	70	3267.8	3276.110	258	9284
France	185	754	594.893	46	1671
Spain	2065	720.2	905.397	17	2511
Variable: Electricity Consumption (kWh)	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Germany	180	11,934.64	159.628	11,745.5	12184
Italy	70	5958.04	51.444	5880.4	6031
France	185	13,103.14	635.006	12,078.7	13888.2
Spain	2065	6323.68	227.284	5970.6	6544

The main descriptive statistics for each of the variables included in the model are presented below (Table 8). The number of observations per variable depends on the data available. As the Amadeus database does not provide information on each variable for all years and companies, and as a result there are missing values, it is necessary to work with unbalanced panel data.

Table 8. Summary of descriptive statistics for each variable.

Variable	Obs	Mean	Std. Dev.	Min	Max
ROI	1575	−0.0002	0.433	−6.03	1.68
FIT	2427	404.050	25.811	319.69	496.03
LOG ASSETS	1698	13.213	2.558	3.669	24.249
LIQ	1518	2.916	8.782	0	92.23
LEV	1665	−48.514	3056.552	−124,211.6	7538.28
AGE	2500	1.694	3.179	0	41
SECACT	2500	0.11	0.312	0	1
SIZE	2500	1.306	0.672	1	4
GERMANY	2500	0.072	0.258	0	1
ITALY	2500	0.028	0.650	0	1
FRANCE	2500	0.074	0.261	0	1
SPAIN	2500	0.826	0.379	0	1

Table 9 shows the average ROI for each country. It can be seen that photovoltaic companies located in Germany were more profitable than in other countries for the period 2008–2012. Indeed, confidence intervals show that, for Germany, we can be 95% confident that the mean ROI of all German companies is between 0.068 and 0.216. This is the only country in which zero is not included in the confidence interval for the mean ROI, and all values in the confidence interval are on the same side of zero (all positive). On the contrary, for French companies, all values in the confidence interval are on the negative side of zero (zero is not included in the confidence interval, either). For both, Italian and Spanish companies, zero is included in the confidence interval. This means that, for most companies, zero can not be rejected and the infinite number of other values in the interval can not be rejected either.

Table 9. Return on investment distribution by countries.

Variable: ROI	Obs	Mean	Std. Dev.	Min	Max	(95% Conf. Interval)	
Germany	45	0.142	0.247	−0.92	0.71	0.0680044	0.21644
Italy	59	0.034	0.182	−0.73	0.65	−0.0132175	0.081692
France	77	−0.037	0.091	−0.33	0.16	−0.0578205	−0.0164652
Spain	1394	−0.004	0.455	−6.03	1.68	−0.0282543	0.0196316

Table 10 shows the average ROI by firm size. It can be seen that photovoltaic companies with the smaller size, the vast majority in this study, were the less profitable for the period 2008–2012. Indeed, Large companies have the higher ROI, and they are the only ones in which zero is not included in the confidence interval for the mean ROI, and all values in such interval are on the positive side of zero.

Table 10. Return on investment distribution by size.

Variable: ROI	Obs	Mean	Std. Dev.	Min	Max	(95% Conf. Interval)	
Very large 4	32	0.033	0.101	−0.34	0.34	−0.0033961	0.0696461
Large 3	143	0.044	0.131	−0.92	0.58	0.0229531	0.0665574
Medium 2	204	−0.015	0.618	−6.03	0.71	−0.1012148	0.0694501
Small 1	1196	−0.003	0.424	−5.93	1.68	−0.0279617	0.0201524

However, despite Germany having an average ROI higher than that of other countries comprising the sample, the following table shows how that country has a FIT lower on average than the other countries during the study period (Table 11). Nevertheless, despite having a lower incentive, that country underwent extraordinary growth rates compared with the rest; specifically, the installed photovoltaic power in Germany rose from 3806 to 7408 MW in the period 2009–2010, with an accumulated power of 35.7 GW at the end of 2012, making it the undisputed leader in Europe. One explanation for this fact can be found in Dusonchet and Telaretti [2] (p. 990), who hold that it was all possible due to '(...) the confidence of stakeholders, the long-term stability of support mechanisms, simplified authorization and permission procedures, and flourishing national industry.'

Table 11. Average FITs values for each country (€/MWh).

Variable: FIT	Obs	Mean	Std. Dev.	Min	Max
Germany	144	368.117	34.704	319.69	411.04
Italy	70	401.174	44.056	335.6	457.29
France	148	468.727	19.167	449.97	496.03
Spain	2065	402.018	14.633	388.71	424.6

3. Results

After estimating the linear panel data model presented in Section 2.1, in this section, we show the results obtained for the fixed effects and the random effects models (Tables 12 and 13).

Table 12. Results for the fixed effects model.

ROI	Coef.	Std. Err.	z	p > |z|	(95% Conf. Interval)	
FIT	0.1729619	0.0218852	7.90	0.000	0.1300162	0.2159075
ASSETS	0.2892791	0.0768426	3.76	0.000	0.1384898	0.4400685
LIQ	0.0781706	0.0372339	2.10	0.036	0.005106	0.1512351
LEV	0.170297	0.0365785	4.66	0.000	0.0985185	0.2420756
AGE	(omitted *)					
SECACT	(omitted *)					
COUNTRY dummies	(omitted *)					
_cons	0.6304124	0.1916555	3.29	0.001	0.2543242	1.006501

Number of obs = 1442; Number of groups = 427; F (4, 1011) = 26.69; Prob > F = 0.0000. * Variables omitted in the fixed effect model estimation because they are time-invariant regressors. Sigma_u: 0.44318566; sigma_e: 0.57860074; rho: 0.36975971. F test that all u_i = 0: F (426, 1011) = 1.72 Prob > F = 0.0000.

Table 13. Results for the random effects model.

ROI	Coef.	Std. Err.	z	p > |z|	(95% Conf. Interval)	
FIT	0.1939975	0.0212704	9.12	0.000	0.1523083	0.2356868
ASSETS	0.2568712	0.0374168	6.87	0.000	0.1835356	0.3302067
LIQ	0.1232263	0.0260231	4.74	0.000	0.072222	0.1742305
LEV	0.1185007	0.0255629	4.64	0.000	0.0683985	0.168603
AGE	0.0149548	0.0064908	2.30	0.021	0.0022331	0.0276765
SECACT	−0.1169538	0.0720403	−1.62	0.104	−0.2581501	0.0242425
GERMANY	0.4205021	0.1473035	2.85	0.004	0.1317926	0.7092117
ITALY	−0.1440266	0.1179864	−1.22	0.222	−0.3752758	0.0872225
FRANCE	−0.2034844	0.3134964	−0.65	0.516	−0.817926	0.4109572
SPAIN	(omitted)					
_cons	0.6500094	0.1087591	5.98	0.000	0.4368456	0.8631733

Sigma_u: 0.25055642; sigma_e: 0.57860074; rho: 0.15791061 (fraction of variance due to u_i). Number of obs = 1442; Number of groups = 427; Wald chi2 (10) = 223.39; Prob > chi2 = 0.0000.

In the fixed effect model estimation (Table 12), the F test shows that the Prob > F is lower than 0.05 (Prob > F = 0.000). Therefore, all the coefficients in the model are different from zero, what justifies an analysis taking into consideration the individual effects, using panel data.

The three variables omitted in the fixed effects model estimation, AGE, SECACT, and COUNTRY dummies are variables which do not vary over time; they are constant for each company. These time-invariant characteristics of the individuals are perfectly collinear with the companies in the sample.

In order to detect possible multicollinearity problems, we applied an ex-post and an ex-ante method. The first one consisted of calculating the correlation matrix for all variables in the study, and it showed that this correlation is not very high (<0.55). The ex-post method applied to detect multicollinearity consisted of testing for the variance inflation factors (VIF). This test also showed the absence of multicollinearity problems (mean VIF: 1.20).

In the random effects model estimation (Table 13), the test (F) to see whether all the model coefficients are different from zero indicates that the model is useful because Prob > chi2 < 0.05 (0.0000).

Both regressions (Tables 12 and 13) show that the main explanatory variable FIT is positive and significant. This result confirms our initial hypothesis, based on previous literature, that these incentives have positively influenced the profitability of photovoltaic companies. The coefficients of the regressors indicate how much the dependent variable in the models (ROI) changes when the explanatory variable increases by one unit.

In addition, all the variables characterizing photovoltaic companies, ASSETS, LIQUIDITY and LEVERAGE, are also positive and significant in both models. Firstly the positive relationship between return on investment and total assets suggests that larger companies may take advantage of the economies of scale generated and, consequently, obtain greater profits [31,36]. As to the positive relationship between liquidity ratio and return on investment, this indicates that the greater ability of companies with higher liquidity to take out loans with financial institutions and conduct investment projects [31] makes them more profitable. Regarding leverage, contrary to expectations, its positive relationship with ROI suggests that companies more able to borrow funds for investing in PV technology, and so with a higher level of debt, are those with most return on investment in the period analyzed.

The variables AGE and dummy COUNTRY 1, Germany—time-invariant variables omitted in the fixed-effects model estimation—are positive and significant in the random model. One explanation for this, based on previous literature, is that companies with longer experience have fewer restrictions on borrowing capacity, and so their ability to invest is higher, increasing their profitability. Regarding the variable COUNTRY 1, a dummy equal to 1 if the company belongs to Germany and zero otherwise, its positive relationship with ROI shows that German PV companies are generally more profitable for the period 2001–2012.

The other variables, SECACT and other dummy COUNTRY, are not significant in any model. It was expected that PV companies with a secondary activity would see an increase in profitability with the diversification of their business to reduce the risk of photovoltaic market saturation, and consequently would avoid any negative impact on profitability. Yet this variable is not significant in any model.

Time-constant variables were omitted in the fixed effects model because they are collinear with the companies. Indeed, fixed effects models cannot be used to investigate time-invariant causes of the dependent variable. Nevertheless, although these variables have been included in the random effects model, as shown in Table 13, most of them are not significant. Given this fact, we decided to base the selection of one of these models on the Haussmann test results. According to the Hausman test, the null hypothesis not being rejected, the use of a fixed effects model was more appropriate. The results for this test (Prob > chi2 = 0.0003) showed we should eventually choose the fixed effects model (Table 14).

Table 14. Hausman Test results.

	Coefficients		(b-B)	Sqrt Diag (v_b-v_B)
	(b) Fe	(B) Re	Difference	S.E.
FIT	0.1729619	0.1913975	−0.0210357	0.0051509
ASSETS	0.2892791	0.2568712	0.032408	0.0671176
LIQ	0.0781706	0.1232263	−0.0450557	0.0266301
LEV	0.170297	0.1185007	0.0517963	0.0261635

b = consistent under Ho and Ha; obtained from xtreg; B = inconsistent under Ha, efficient under Ho; obtained from xtreg; Test: Ho, difference in coefficients not systematic; chi2 (4) = (b-B)′[(V_b-V_B)^(-1)](b-B) = 20.91; Prob > chi2 = 0.0003.

After the Haussmann test, we perform a modified Wald test for groupwise heteroscedasticity in the fixed effect model, implemented in Stata by Christopher Baum [37]. The results ($p < 0.05$) indicate that we must reject the null hypothesis of homoscedasticity.

We also need to test for serial correlation which is very likely to appear in an individual-effects model. We use a test for serial correlation in the idiosyncratic errors of a linear panel-data model implemented by David Drukker [37]. The probability obtained for our fixed effect model is 0.0616 (Ho: no first-order autocorrelation; F (1, 245) = 3.527; Prob > F = 0.0616). Therefore, at a 5% level of significance, we have enough statistical evidence for not to reject the null hypothesis. This indicates that the errors are not auto correlated.

In order to face the identified heteroscedasticity problem in our fixed-effect model to avoid biased statistical results, we run a fixed-effects (within) regression with Driscoll and Kraay standard errors [37] (Table 15).

Table 15. Fixed-effect (within) regression with Driscoll and Kraay standard errors.

ROI	Coef.	Drisc/Kraay Std. Err.	t	p > |t|	(95% Conf. Interval)	
FIT	0.1729619	0.0271206	6.38	0.000	0.119655	0.2262687
ASSETS	0.2892791	0.081652	3.54	0.000	0.1287882	0.4497701
LIQ	0.0781706	0.0645753	1.21	0.227	−0.0487553	0.2050964
LEV	0.170297	0.0236888	7.19	0.000	0.1237355	0.2168586
_cons	0.6304124	0.14659	4.30	0.000	0.3422827	0.9185421

Number of obs = 1442; Number of groups = 427 F (4, 426) = 28.71; Prob > F = 0.0000; within R-squared = 0.0955.

The resulted econometric model, showed below, confirms the positive correlation between the feed-in tariff, the main treatment variable, and the ROI. The explanatory variables included in the model as control ones, the level of assets and the level of leverage, remain significant and positively correlated with the ROI.

$$\text{ROI} = 0.6304 + 0.1729\ \text{FIT} + 0.2892\ \text{ASSETS} + 0.1702\ \text{LEVERAGE}$$

4. Discussion

Extensive previous literature shows how FITs policies have been fundamental and effective in the development of renewable energies in Europe. To concentrate on the photovoltaic sector, FITs have allowed an extraordinary growth in the installed photovoltaic power in European countries. Numerous authors have published studies dealing with the effect of these policies on the profitability of production facilities of this type of energy, although previous empirical studies analyzing their effect on the profitability of companies dedicated to photovoltaic production have not been found. For this reason, the objective of our study was to analyze the influence of FITs on the financial profitability of the companies carrying out their activity in the four most representative photovoltaic markets (Germany, Italy, France and Spain), more specifically in the period 2008–2012.

To achieve our objective, a static linear panel data model was applied. Both, the fixed and the random effects models were estimated, and the Hausman test confirmed the suitability of the first one. The variables considered were the average FIT for each country and year, and variables describing different characteristics of the companies.

The fixed effects model's results confirm the positive, significant influence of FITs policies on the profitability of photovoltaic companies, which had been deduced from a prior review of the existing literature. With regard to the company variables, total assets and leverage turned out to be determinant in explanation of ROI.

Since the introduction of the first FITs in Germany in the early 21st century, FITs have been introduced in many other countries to give certainty to investors regarding the return on their investment and to promote photovoltaic energy generation. Increasing this renewable source of energy generation would reduce greenhouse gas emissions, a major objective for countries worldwide. Table 7 shows that Germany is the country in the sample with the highest level of CO_2 emissions and also with the highest PV capacity.

During the study period (2008–2012), PV technology was far more expensive than today, especially in countries such as Spain, given the lack of experience and the need for research and development. The main problem in this country was the sudden drop in the feed-in tariff, which in some cases led to major problems in paying off investors' financial debts. But currently it is possible to get an appropriate return on investment in PV energy generation despite the fall in the FIT per kWh, because the cost of the technology installed has also fallen.

Regarding the policy implications of these incentives, Cointe and Nadaï [38] analyze the historical trajectory of FITs as an instrument for the promotion of renewable energy in Europe. They look at the emergence and transformations of FITs as part of the policy arsenal developed to encourage the creation of markets for such energy. In our opinion, there is a mismatch between EU energy policy and liberalization as a key aim in the EU, and Member States' interests and ways of regulating incentives for renewable energy generation. Accordingly we agree with the conclusion of [38] that there are two interwoven storylines: that of the European Commission's perspective on renewable energy policy, and that of the actual, more bottom-up emergence and evolution of FITs in Member States. They also highlight the intersection between environmental objectives, technological change and the ambition to liberalize the internal electricity market.

The variables in our study positively influencing ROI from 2008 to 2012, i.e., FITs, size (level of assets), and level of leverage, were the same ones which, shortly afterwards, led to problems for investors due to inappropriate government planning and policymaking. Companies with more experience were less affected by the sudden cuts in some countries.

With better policymaking, it would have been possible to avoid the problems detected in some countries, such as uncontrolled growth of PV installations or increase in electrical system costs [2,25].

Finally, with regard to future research, firstly, the possible continuation of profitability could be analyzed using a dynamic model. Secondly, the existing empirical literature could be enlarged upon by analyzing the factors determining the adoption of FIT policies, and which might contribute to efficient or optimum policy design.

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References

1. Canton, J.; Johannesson Lindén, A. Support schemes for renewable electricity in the EU. *Econ. Pap.* **2010**, *408*. Available online: http://ec.europa.eu/economy_finance/publications/economic_paper/2010/pdf/ecp408_en.pdf (accessed on 28 June 2016).
2. Dusonchet, L.; Telaretti, E. Economic analysis of different supporting policies for the production of electrical energy by solar photovoltaics in western European Union countries. *Energy Policy* **2010**, *38*, 3297–3308. [CrossRef]
3. Lesser, J.A.; Su, X. Design of an economically efficient feed-in tariff structure for renewable energy development. *Energy Policy* **2008**, *36*, 981–990. [CrossRef]
4. Lipp, J. Lessons for effective renewable electricity policy from Denmark, Germany and the United Kingdom. *Energy Policy* **2007**, *35*, 5481–5495. [CrossRef]
5. Johnstone, N.; Hascic, I.; Popp, D. Renewable energy policies and technological innovation: Evidence based on patent counts. *Environ. Res. Econ.* **2010**, *45*, 133–155. [CrossRef]
6. Campoccia, A.; Dusonchet, L.; Telaretti, E.; Zizzo, G. An analysis of feed-in tariffs for solar PV in six representative countries of the European Union. *Sol. Energy* **2014**, *107*, 530–542. [CrossRef]
7. Haas, R.; Panzer, C.; Resch, G.; Ragwitz, M.; Reece, G.; Held, A. A historical review of promotion strategies for electricity from renewable energy sources in EU countries. *Renew. Sustain. Energy Rev.* **2011**, *15*, 1003–1034. [CrossRef]
8. Ragwitz, M.; Winkler, J.; Klessman, C.; Gephart, M.; Resch, G. Recent Developments of Feed-in Systems in the EU—A Research Paper for the International Feed-in Cooperation. 2012. Available online: http://www.feed-in-cooperation.org/wDefault_7/download-files/research/101105_feedin_evaluation_update-January-2012_draft_final_ISI.pdf (accessed on 28 June 2016).
9. International Energy Agency (IEA). Trends in Photovoltaic Applications 2013. Available online: http://www.iea-pvps.org/fileadmin/dam/public/report/statistics/FINAL_TRENDS_v1.02.pdf (accessed on 28 June 2016).
10. Di Dio, V.; Favuzza, S.; La Cascia, D.; Massaro, F.; Zizzo, G. Critical assessment of support for the evolution of photovoltaics and feed-in tariff(s) in Italy. *Sustain. Energy Technol. Assess.* **2015**, *9*, 95–104. [CrossRef]
11. Campoccia, A.; Dusonchet, L.; Telaretti, E.; Zizzo, G. Comparative analysis of different supporting measures for the production of electrical energy by solar PV and Wind systems: Four representative European cases. *Sol. Energy* **2009**, *83*, 287–297. [CrossRef]
12. Jenner, S.; Groba, F.; Indvik, J. Assessing the strength and effectiveness of renewable electricity feed-in tariffs in European Union countries. *Energy Policy* **2013**, *52*, 385–401. [CrossRef]
13. Breyer, Ch.; Birkner, Ch.; Kersten, F.; Gerlach, A.; Goldschmidt, Ch.; Stryi-Hipp, G.; Montoro, D.F.; Riede, M. Research and development investments in PV—A limiting factor for a fast PV diffusion? In Proceedings of the 25th European Photovoltaic Solar Energy Conference and Exhibition/5th World Conference on Photovoltaic Energy Conversion, Valencia, Spain, 6–10 September 2010.
14. European Photovoltaic Industry Association (EPIA). Global Market Outlook for Photovoltaics 2014–2018. Available online: http://www.epia.org/news/publications/ (accessed on 12 April 2014).
15. Couture, T.; Cory, K.; Krycik, C.; Williams, E. A Policymaker's Guide to Feed-in Tariff Policy Design. National Renewable Energy Laboratory (NREL) Technical Report NREL/TP-6A2-44849. 2010. Available online: https://www.nrel.gov/docs/fy10osti/44849.pdf (accessed on 5 November 2016).
16. Ayoub, N.; Yuji, N. Governmental intervention approaches to promote renewable energies. Special emphasis on Japanese feed-in tariff. *Energy Policy* **2012**, *43*, 191–201. [CrossRef]
17. Schallenberg-Rodríguez, J.; Haas, R. Fixed feed-in tariff versus premium: A review of the current Spanish system. *Renew. Sustain. Energy Rev.* **2012**, *16*, 293–305. [CrossRef]
18. Ciarreta, A.; Espinosa, M.P.; Pizarro-Irizar, C. Is green energy expensive? Empirical evidence from the Spanish electricity market. *Energy Policy* **2014**, *69*, 205–215. [CrossRef]
19. Couture, T.; Gagnon, Y. An analysis of feed-in tariff remuneration models: Implication for renewable energy investment. *Energy Policy* **2010**, *38*, 955–965. [CrossRef]
20. Held, A.; Ragwitz, M.; Gephart, M.; De Visser, E.; Klessman, C. Design Features of Support Schemes for Renewable Electricity. ECOFYS Sustainable Energy for Everyone. 2014. Available online: http://www.ecofys.com/en/publication/renewable-electricity-support-schemes-and-cooperation-mechanisms-in-/ (accessed on 13 November 2014).

21. García-Álvarez, M.T.; Mariz Pérez, R.; DeLlano-Paz, F. Políticas de promoción de las energías eólicas y solar: Los casos de Alemania y España. *Cuadernos Económicos del ICE* **2012**, *84*, 157–172. Available online: http://www.revistasice.com/CachePDF/CICE_84___24A7971CF22AC088CD700CA53318E424.pdf (accessed on 5 November 2016).
22. Cory, K.; Couture, T.; Kreycik, C. Feed-in Tariff Policy: Design, Implementation, and RPS Policy Interactions. NREL/TP-6A2-45549. 2009. Available online: http://www.nrel.gov/docs/fy09osti/45549.pdf (accessed on 5 November 2016).
23. Del Río, P.; Gual, M. The promotion of green electricity in Europe: Present and future. *Eur. Environ.* **2004**, *14*, 219–234. [CrossRef]
24. Lüthi, S. Effective deployment of photovoltaics in the Mediterranean countries: Balancing policy risk and return. *Sol. Energy* **2010**, *84*, 1059–1071. [CrossRef]
25. International Energy Agency (IEA). Technology Roadmap Solar Photovoltaic Energy. 2014. Available online: http://www.iea.org/publications/freepublications/publication/TechnologyRoadmapSolarPhotovoltaicEnergy_2014edition.pdf (accessed on 21 May 2015).
26. Menanteau, P.; Finon, D.; Lamy, M.-L. Prices versus quantities: Choosing policies for promoting the development of renewable energy. *Energy Policy* **2003**, *31*, 799–812. [CrossRef]
27. European Photovoltaic Industry Association (EPIA). Retrospective Measures at National Level and Their Impact on the Photovoltaic Sector. 2013. Available online: http://www.epia.org/fileadmin/user_upload/Press_Releases/Restrospective_Measures_at_national_level.pdf (accessed on 21 November 2015).
28. Ayompe, L.M.; Duffy, A.; McCormack, S.J.; Conlon, M. Projected costs of a grid-connected domestic PV system under different scenarios in Ireland, using a measured data from a trial installation. *Energy Policy* **2010**, *38*, 3731–3743. [CrossRef]
29. Sarasa-Maestro, C.J.; Dufo-López, R.; Bernal-Agustín, J.L. Photovoltaic remuneration policies in the European Union. *Energy Policy* **2013**, *55*, 317–328. [CrossRef]
30. Talavera, D.L.; Nofuentes, G.; Aguilera, J. The internal rate of return of photovoltaic grid-connected systems: A comprehensive sensitivity analysis. *Renew. Energy* **2010**, *35*, 101–111. [CrossRef]
31. Jaraité, J.; Kazukauskas, A. The profitability of electricity generating firms and policies promoting renewable energy. *Energy Econ.* **2013**, *40*, 858–865. [CrossRef]
32. Winkel, T.; Rathmann, M.; Ragwitz, M.; Steinhilber, S.; Winkler, J.; Resch, G.; Panzer, Ch.; Busch, S.; Konstantinaviciute, I. *Renewable Energy Policy Country Profiles*, 2011 version; Prepared within the Intelligent Energy Europe Project RE-Shaping. Contract No. EIE/08/517/SI2.529243; European Commission: Brussels, Belgium, 2012.
33. European Photovoltaic Industry Association (EPIA). Global Market Outlook for Photovoltaics until 2013. Available online: http://ec.europa.eu/economy_finance/events/2009/20091120/epia_en.pdf (accessed on 11 July 2015).
34. European Photovoltaic Industry Association (EPIA). Global Market Outlook for Photovoltaics until 2015. Available online: http://www.heliosenergy.es/archivos/eng/articulos/art-2.pdf (accessed on 8 May 2016).
35. Del Río, P.; Mir-Artigues, P. A Cautionary Tale: Spain's Solar PV Investment Bubble. The International Institute for Sustainable Development and the Global Subsidies Initiative. February 2014. Available online: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.441.9052&rep=rep1&type=pdf (accessed on 18 June 2016).
36. Goddard, J.; Tavaloki, M.; Wilson, O.S. Determinants of profitability in European manufacturing and services: Evidence from a dynamic panel model. *Appl. Financ. Econ.* **2005**, *15*, 1269–1282. [CrossRef]
37. Vasilescu, D.; Cristescu, A.; Cataniciu, N. *Panel Data Analysis of the Connection between Employee, Remuneration, Productivity and Minimum Wage in Romania. Recent Advances in Mathematics and Computers in Business, Economics, Biology & Chemistrya*; National Scientific Research Institute for Labor and Social Protection: Bucharest, Romania, 2018; ISBN 978-960-474-194-6.
38. Cointe, B.; Nadaï, A. *Feed-in Tariffs in the European Union. Renewable Energy Policy, the Internal Electricity Market and Economic Expertise*; Palgrave Macmillan: London, UK, 2018; ISBN 978-3-319-76321-7.