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Is Feed-in Tariff forever? An Empirical Analysis

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Abstract **–** The aim of this study was to analyze the key–factors behind the adoption of Feed– in Tariff and the functional relationship between Gross Domestic Product, Carbon Dioxide emissions and the Share of Renewable (non-hydroelectric) electricity generation. To address these issues a panel binary regression model has been estimated in a comprehensive sample of 60 countries with different economic structure over the period 1980–2008. We control for variables for socioeconomic, environmental and policy characteristics. Results showed that factors included in the model were relevant for the policy decision to adopt Feed–in Tariff and that they are linked with this by a nonlinear relationship. By the analysis of the results can be demonstrate that Feed-in Tariff is not forever. FiT, in fact, is an important policy to incentive the RES generation, but it reaches a turning point in which should be revise, or eliminate, from the promotion policies.

Keywords **–** Binary time series, feed-in tariff, marginal effects, regulatory policy, renewable sources.

1. INTRODUCTION

The lack of sustainability of the electricity generation by fossil fuels (coal, gas and oil) brings into question their use in long-term energy development strategies. Countries multiply the recourse to the generation by renewable energy sources (RES) that are becoming increasingly important in the energy generation mix of countries. RES can reduce global climate change and the dependence on fossil fuels. They also increase portfolio generation mix, and promote the local economic development. For this reason, Governments try to promote the investments with incentives and /or grants. There is a wide range of policies being used to support renewable energy development and an overview can be found in a report by [1]. As the same report highlights, the Feed in Tariff (FiT) is the most applied national policy instrument to promote RES.

There is a plenty of literature about RES and policy instruments and, for sake of simplicity, literature was divided in two main topics: the former, in which Authors described policies, and the latter in which policies was included as key factors explaining investments in RES. Dong [2] analyzed the effectiveness of FiT and renewable portfolio standard (RPS) in the development of wind generation. He found that FiT policies had a positive effect on RES development while RPS policies had a negative effect. Islam and Meade [3] measured household level preferences for solar panels and used these preferences along with household characteristics to predict adoption time intentions while [4] proposed a system dynamic model in order to assess which policy, or combination of policies, promoting solar PV applications had the greatest economic benefit. He found that FiT could be considered a good approach for promoting the photovoltaic generation. Stokes [5] presented a case study of Ontario's FiT policies between 1997 and 2012 to analyze how the political process affects renewable energy policy design and implementation and [6] proposed an innovative two part FiT, consisting of both a capacity payment and a market-based energy payment, which can be used to meet the renewable policy goals of regulators. They found that the proposed two part tariff is easy to implement, and avoids the problems caused by distorting wholesale energy markets through above-market energy payments.

Other studies examined the effect of policies in the promotion of investment in RES. Marques *et al.* [7] analyzed the drivers promoting renewable energy in European countries and found that lobbies of traditional energy sources and CO_2 emission restrained renewable deployment. Evidently, the need for economic growth suggests an investment that supports, but does not replace, the before installed capacity. For this reason [8] investigated the drivers of investments in RES in a panel of OECD and developing (Brazil, China and India) countries. In particular, they analyzed the key factors and the divergences underlying the investments in RES in countries that produce electricity using, or not, nuclear power plants. In a recent paper, [9] have proponed a dynamic panel model in order to explain the determinants of investments in RES in OPEC members. They found that lack of grants and/or incentives to promote the installations of new renewable power plants is a limit for the future and sustainable development of these countries.

The aim of the paper was twofold. Firstly, the determinants driving a country's choice of adopting FiT were identified. Secondly, the paper investigate if exist a threshold level of GDP, carbon dioxide emission and share of generation by renewables that reduce the probability to adopt the FiT. The level of the covariates that suggests changing or deleting the FiT are individuated.

These issues were addressed using a static probit panel model estimated over a panel specification.

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A panel probit rather than a multinomial panel model was chosen because countries could adopt different promotion policies at the same time. So, it was not possible to categorize the outcome variable in order to estimate a multinomial model on the basis of the support policies adopted. FiT was focused on because it represents one of the most widespread regulatory promotion policy used in the world (see, e.g. [10])[1]. Furthermore, [2] found that FiT performs better than Renewable Portfolio Standard (RPS) and has better long-term effects.

For this reason a comprehensive dataset of 60 countries with distinct economic and social structures as well as different levels of economic development in the years between 1980 and 2008 was considered. Sample included OECD, South American, Asian and African countries. This dataset can be used to assess the effect of macroeconomic variables and to suggest to policymakers the need to adopt the FiT.

The organization of the paper is as follows: Section 2 describes data while Section 3 analyzes the model while. Section 4 reports the empirical results discussing about the policy implications. Section 5 reports the estimated Marginal Effects. Concluding remarks are in Section 6.

2. DATA

Annual data from 1980 to 2008 obtained from the U.S. Energy Information Administration (EIA) and International Renewable Energy Agency (IRENA) are employed. The panel dataset consists of 60 countries and it is highly balanced. All the countries included in the sample had a share of electricity generated by RES but around 40% of our sample did not adopt the FiT. In this way we take into consideration also countries that generate electricity with RES but do not adopt this policy instrument to stimulate new RES power plants. The variables used limit the major economic, generation, and environmental factors from which investment decisions was originated and influence the policymakers. As in [1] the explanatory variables were classified in four homogeneous factors:

- Environmental (total CO_2 emission from energy consumption);
- Economics (electricity consumption; GDP per capita; energy security);
- Generation (share of non-hydroelectric renewable generation; share of nuclear generation; share of fossil generation);
- Policy (adoption of Kyoto protocol).

In the class of environmental factor was considered the total carbon dioxide emissions (CO_2) from the consumption of energy measured as million metric tons (Mtoe). CO_2 emissions were able to capture the environmental degradation due to economic development. The use of total CO_2 instead of per capita CO_2 seems appropriate because international recommendation and agreements binding targets for reducing total greenhouse gas (GHG) emissions. Obviously, the carbon dioxide emission is a proxy of environmental degradation and not the only responsible[2]. The expected result is a coefficient with a significant positive effect. The presence of a negative effect emphasizes the persistence of an economy tied to fossil fuels, which is still unable to replace the traditional energy sources.

Among the economic factors, we include the per capita GDP, per capita consumption of energy and a proxy for the energy security of supply. The GDP is a primary indicator in the economic, measured as PPP constant 2011 U. S. dollars, it is directly related to energy consumption. Also, it is the main growth indicator and it is used as a proxy of income [11]. Generally, it is assumed that richer countries are able to better support investments in renewable sources. However, transformation costs or power plants' conversion can be high for some countries and policy decisions may discourage investments.

The consumption of electricity, measured as billion KWh, is considered a proxy for economic development of the country [12]. Nevertheless, it also represents the evolution of energy demand. In fact, the need to meet the energy demand can lead to the creation of new power plants based on renewable sources, increasing investments. However, if the increasing demand was met through traditional power plants based on fossil fuel, then the effect on investment will be negative instead.

A similar argument can be applied to energy security, approximated by the degree of dependence on foreign supplies of electricity and measured as billion KWh. As it is known, the power grid interconnections require a constant exchange of energy between the countries, which buy and sell energy at different times of the day, in a regulated market. It is known that some countries produce, on average, more than the share consumed, (e.g. France) other less (e.g. Italy). The need to increase their share of production (reducing the energy bill) and to reduce dependence could increase investment in renewable sources.

The class of generation factors includes share of non-hydroelectric renewable generation, the share of nuclear generation and the share of fossil generation.

The share of non-hydroelectric renewable generation (ShRENNH), i.e. the ratio between non-hydro renewable generation and total net electricity generation, is considered a proxy for investments in RES [8]- [9]. The effect is expected positive. In fact, FiT is mainly related to incentive the investments in the other sources rather than hydroelectricity. Much of the world's electricity is generated thermally using non-renewable (fossil) fuels. Thermal generation (ShTHER), which generally burns natural gas, diesel, coal and oil, has both a high environmental impact and presents increasing

[1] Also the Renewable Portfolio Standard (also known as quota system) is a widely used regulatory policy.

[2] The International Energy Agency evaluates that CO_2 from energy represents about three quarters of the anthropogenic GHG emissions for Annex I countries, and over 60% of global emissions.

generation costs[3]. Finally, among generation factors we include the share of the generation from nuclear sources (ShNUC). The nuclear energy generation occurs only in some countries, mainly rich countries. Furthermore, there is a strong aversion to these sources in some countries because of recent accidents that have affected the development of the sector and because of some critical issues related to the supply of raw material and political risks. Without going into details, we must stress that the energy from nuclear sources is CO_2 free and it ensures a high efficiency. For the last two-generation factors, the coefficients are expected to be negative.

The adoption of Kyoto protocol[4] was considered as policy factor. Alongside the agreement to negotiate a new climate agreement by 2015, 38 countries have agreed to take commitments under a second commitment period of the Kyoto Protocol to begin in 2013.

Clearly, not all aspects of a complex phenomenon like the decisions to adopt some grants for investments in renewable energy can be disclosed in the present work. Some critical issues, such as the reprogramming of the energy plan, the identification of suitable sites and installations, problems related to the resident population, the environmental impacts, are not taken into account but are factors that affect investment decisions and the installed capacity.

3. THE PANEL PROBIT MODEL

Let us define $Y_t \in (0,1)$ as the binary time series that, at the generic time *t*, assumes the value 1, if the *i-country* adopted the FiT, 0 otherwise. The aim was to model the conditional probability $P(Y_t = 1 \mid I_{t-1})$, where I_{t-1} is the information set available at time *t*, and I_t is approximated by the set of regressors[5]. We assume that conditional on I_{t-1}, Y_t has a Bernoulli distribution with probability P_t , or $Y_t|I_{t-1} \sim B(P_t)$.

We employ a monotonically increasing transformation function Φ and assume the relation $P_t = \Phi(\pi_t)$, where $\pi_{i,t}$ is specified as a linear function of variables given all the information at the time *t-1*.

Thus, the expected value of *Y* at the time *t+1*, conditionally on the information available at the time *t* is given by $E_t(Y_{t+1}|I_t) = \Phi(\pi_t) = P_t$.

Φ is usually assumed as the cumulative distribution function (*cdf*) of a standard Normal distribution or a logistic distribution. The former assumption leads to the probit model and the latter to the logit model[6]. In our empirical application, we assume that $\Phi(.)$ is the *cdf* of a standard Normal distribution and the probit model is used[7].

In the literature, different equations of have been proposed, in the class of binary time series [14]- [16].

In this work we improve the traditional probit models attempting to explain the decision to adopt the FiT also in terms of the individual characteristics. This approach includes determinants related to the heterogeneity in the dataset and the traditional aspects more often used in such typology of analysis.

Since our idea is to consider also the country's individual characteristics, we decided to explain the variation in the choices to adopt, or not, the FiT following a static probit panel approach:

$$\pi_{i,t} = \alpha + \beta' \mathbf{X}_{i,t-k} + z_{i,t} \tag{1}$$

where, for each *i-country*:

$$\pi_i|\boldsymbol{X}_{it-k} \sim Normal(\alpha + \boldsymbol{\beta}'\boldsymbol{X}_{i,t-k};\ \sigma_\beta^2), \tag{2}$$

where $\pi_{i,t}$ is the propensity to adopt the FiT, β is an unknown parameter vector, $\mathbf{X}_{i,t-k}$ is a matrix of characteristics, and $z_{i,t}$ is the error component:

$$z_{i,t} = u_i + \varepsilon_{i,t} \tag{3}$$

which follows a one-way error component model where u_i denotes a country-specific effect, $\varepsilon_{i,t}$ denotes a year-specific effect and $u_i \sim IID(0, \sigma_u^2)$ and $\varepsilon_{i,t} \sim IID(0, \sigma_\varepsilon^2)$.

In particular, it was assumed that $z_{i,t}$ was independent and identically distributed with zero mean and fixed variance. The individual specific unobserved effect was uncorrelated with the independent variables and the error term and invariant across time. Moreover, the effects from different individuals were potentially correlated.

For the estimation of the coefficients of the panel probit models, fixed effects estimator [17] are often used or procedures based on instrumental variables [18]-[19]. These methods do not allow for heterogeneity in the error components and there thus they cannot be employed.

The choice of a random model aims to avoid the collinearity due to the presence of time-invaring variables (like energy imports, constantly equal to zero for several countries); while the choice of the static specification is due to the specific nature of the phenomena not compatible with a dynamic specification, considering that once a country adopt the tariff is inclined to preserve it excluding cycling movement.

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[3] Despite the growth of non-fossil energy, the share of fossil fuels within the world energy supply is relatively unchanged over the past 40 years. In 2011, fossil sources accounted for 82% of the global TPES. Generation of electricity and heat worldwide relies heavily on coal, the most carbon intensive fossil fuel. Countries such as Australia, China, India, Poland and South Africa produce over two-thirds of their electricity and heat through the combustion of coal [13].

[4] The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits industrialized countries (as a group) to curb domestic emissions by about 5% relative to 1990 by the 2008 first commitment period.

[5] This assumption means that the conditional probability P_t cannot depend on contemporaneous values of the components of the vector of explanatory variables.

[6] The evaluation of the better specification relied on the probit and logit coefficients. Results of both models are very similar either in terms of value or significance of coefficients. However probit performs better than the logit model (comparison has been made using the most common indices of goodness of fit and results are available by the authors on request), thus it has been chosen as preferred specification.

[7] Any twice continuously differentiable cumulative distribution function could be employed.

Pinheiro and Bates [20] review several methods for estimating the parameters in a nonlinear mixed effect model based on ML procedures. In this work, the maximum likelihood method proposed by [21] has been used in order to estimate the parameters of the Equation 1 (has been assumed *k* = *1*) and the unobserved heterogeneity of the random effects probit model.

The following panel probit random model is estimated and considered for the forecasting procedure:

$$\pi_{i,t} = \alpha_i + \beta_1 lnCO_{2;i,t-k} + \beta_2 lnConsumption_{i,t-k} + \beta_3 lnGDP_{i,t-k} + \beta_4 Imports_{i,t-k} + \beta_5 lnShRenNh_{i,t-k} + \beta_6 Kyoto_{i,t-k} + \beta_7 ShTher_{i,t-k} + \beta_8 ShNuc_{i,t-k} + z_{i,t} \quad (4)$$

where for country *i* (i = *1, …, N*) at time *t* (*t = 1, …, T*), $lnCO_{2;i,t}$ was the natural logarithm of the total carbon dioxide emissions from energy use, $lnConsumption_{i,t}$ was the natural logarithm of the electricity consumption, $lnGDP_{i,t}$ was the natural logarithm of GDP per capita, $Imports_{i,t}$ was the net imports of electricity (proxy for energy security), $ShRenNh_{i,t}$ was the share of the non-hydroelectric renewable generation, $Kyoto_{i,t}$ was a binary variable indicating the adherence to the Kyoto protocol in the specific *t-year*, $ShTher_{i,t}$ was the share of thermal (fossil) generation, $ShNuc_{i,t}$ was the share of nuclear electricity generation and $z_{i,t}$ was the error component.

The choice of a random model was aimed to avoid the collinearity due to the presence of time-invaring variables (like the energy imports or share of nuclear generation, constantly equal to zero for several countries) present in the analysis.

4. RESULTS

Table 1 summarizes results obtained by the ML estimation of the static model under the panel specification of the Equation 4.

Coefficients of the model were in line with the expected results and the significance of the standard deviation (σ_u) of the effects have confirmed the presence of the heterogeneity between the countries and validated the choice of the random model.

Except for the electricity consumption that, as expected, was negatively linked to the outcome variable the increasing in one of explanatory variable was directly related to the increase in the probability to adopt the FiT. This was an important result that suggests that countries have considered FiT a useful instruments to promote the RES in order to reduce the carbon emissions (especially after the Kyoto protocol ratification). Moreover, a direct relationship with the GDP has been individuated. The increasing in GDP and in living conditions in the countries has allowed to introduce the policy incentives for the RES deployment. Also the energy security presents a significant coefficient. The need to become energy independent suggests to policymakers to increase the probability to adopt FiT.

The relationship between the outcome variable and the generation factors was not significant. This type of policy was unconnected with these factors and this was probably due to the need to generate however electricity using other sources that guarantees the base loads and peak electricity. For the share of non-hydroelectric renewable generation there is a significant coefficients. Increasing the RES generation increase the probability to adopt FIT. These results confirmed the basic idea. FiT is a complex promotion policy that depends by several factors. The homogeneous factors individuated, that represent socio-economics, environmental and generations features, contributes to the decision process of FiT adoption.

Table 1. Estimates, standard errors, p-values of the estimated panel probit model.

Variable	Estimates	Standard Errors	P - values
Intercept	-9.656	1.392	0.000
$lnCO_2$	0.349	0.039	0.000
LNCONS	-0.236	0.123	0.055
LnGDP	0.741	0.156	0.000
Imports	0.057	0.034	0.095
ShRENNH	3.229	1.076	0.003
ShTHER	-0.168	0.195	0.388
ShNUC	-0.160	0.335	0.633
Kyoto	0.423	0.181	0.020
σ_u	1.114	0.284	0.000

5. ESTIMATING THE MARGINAL EFFECTS

The significant estimation results demonstrate that the increasing in carbon emission, GDP and share of renewable generation increase the probability to adopt FiT. In fact, the coefficients related to these variables were highly significant and positive.

GDP, CO_2 and ShRENNH appear, therefore, as a "fly-wheel effect" in the choice to adopt the FiT and empirical occurrences seem to confirm this evidence. Almost all of the countries which are classified by the World Bank as "high income", have already adopted the FiT at the end of the 2008. As reported in Table 2, these countries are also responsible to a large extend of carbon emission (about 43% of total CO_2 emissions in 2008) and have a large renewable installed capacity (about 8%). Countries included in the lower and upper middle income present a decreasing share of CO_2 emission and share of renewable. For the last variable, we can observe that the share of renewable in lower middle income group is greater than in upper middle income countries. This is probably due to the effect of the Clean Development Mechanism (CDM).

Table 2. Income group countries and average GDP per capita, CO_2 emissions and renewable generation.

Income groups	Number of Countries	AGDPpc	PCA	CO_2	ShREN
Lower Middle Income	17	3022$	35%	144	6.98%
Upper Middle Income	19	9873$	37%	181*	2.61%
High Income	24	34696$	79%	511	7.73%

*: If China is included, the CO_2 emission are 523.46Mtoe.

Analysing the sample, we observe that 17 countries belong in the group of low and lower middle income and only the 35% (PCA, third column) of these countries have, at the end of 2008, adopted the FiT. The average value of GDP per capita (AGDPpc) of this group is 3,022$. In the upper middle income group FiT is adopted by the 37% (AGDPpc is 9,873$) of the countries included while for the high income countries is 79%. By the analysis of the Table 2 we observe that an increasing in GDP increase also the shares of renewable and the total emissions.

With this in mind, we suspect that exist a threshold level of these variable over which the relationship is reversed. In other words, increasing GDP, CO_2 emission and Share of Renewable increase the probability to adopt the FiT. But, if countries reach a high level of these variables, the probability decreases and countries can eliminate the regulatory policy. For this reason a marginal effect analysis was carried out on the GDP, CO_2 and ShRENNH coefficients.

A Marginal Effect (ME), or partial effect, measures the effect on the conditional mean of y of a change in one of the regressors, say X_k. For continuous independent variables, the marginal effect measures the instantaneous rate of change. If the instantaneous rate of change is similar to the change in $P(Y=1)$ as X_k increases by one, this can be quite useful and intuitive too. However, there is no guarantee that this will be the case; result, in part, will depend on how X is scaled. With this specification, the marginal effects of the influence on a predicted value $E_t\ (Y_{t+1})$ must be calculated using the chain rule:

$$\frac{\delta Y}{\delta x_k} = \beta_k \frac{\delta \Phi}{\delta \mathbf{x}'\beta} \qquad (5)$$

so that the marginal effect of the variable x depends, for a generic *i - country*, on the derivative $\frac{\delta \Phi}{\delta \mathbf{x}'\beta}$. In order to calculate marginal effects as defined in 5 we use the [22] average marginal effect (AME) approach:

$$\frac{\delta E(Y_{i,t+h})}{\delta x_{i,k}} = \beta_k \frac{\sum_{t=1}^{T} \Phi(\mathbf{x}'b)}{T} \qquad (6)$$

where T are the time-observations in the dataset for each country and is the probability density function for the normal distribution. The marginal effects for each variable can be calculated by using the estimated coefficients b multiplied by the average value of all appropriately transformed predicted values [23]. They can be seen as an informative mean for summarizing how change in a response is related to change in a covariate. For categorical variables, the effects of discrete changes are computed, i.e., the effects for categorical variables show how $P(Y = 1)$ is predicted to change as X changes from 0 to 1 holding all other X_s equal. This can be quite useful, informative, and easy to understand.

The effect of a change in X_k on $P(Y=1)$ depends on the values of all the X variables. Therefore, it is often useful to compute marginal effects at a range of values. The marginal effects for both the specifications are calculated using the Equation 6, and show that the marginal variation $\delta Y / \delta x_k$, where x_k are the covariates, is significant. Considering that the variables included in the estimation model are continuous (except Kyoto), it is possible to estimate the ME in a range of values and report graphically the partial effects obtained. In this way we can observe how the probability to adopt the FiT changes for the different level of covariates. In particular, we are interested in the ME for GDP because this indicator is the most important to describe the effects of economic development. The ME for GDP was reported in Figure 1.

Observing the pattern in the ME of per capita GDP, we note that ME for GDP increases in a first part and then decreases. This result confirms that economic growth is certainly one of the major causes of the FiT adoption. This result is in line with Romano et al. [24]. The growth of GDP and the increasing living conditions suggest to policymakers to introduce policy incentives for renewable generation. However, reaching a high level of economic growth, the marginal effects decrease probably because they have already introduced forms of RES incentive and then further increases in income become less and less crucial to direct the decision of adopt this kind of policies. The turning point is near 40,000$ per capita in our model specification.

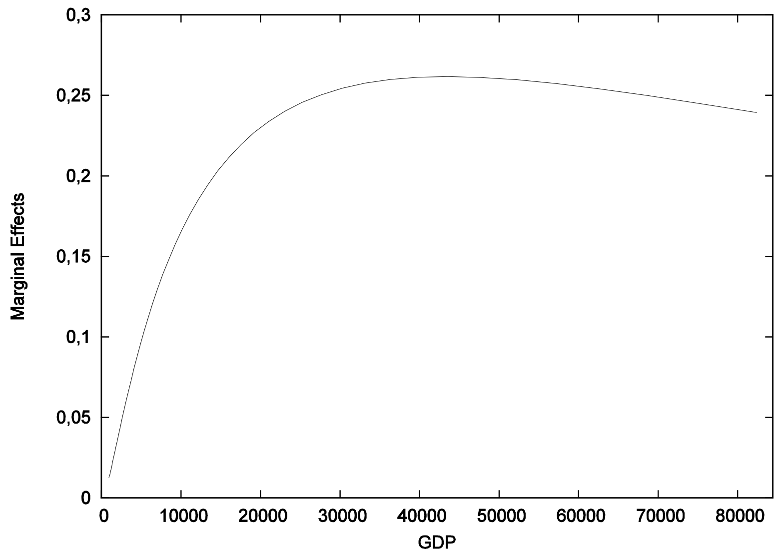

Fig. 1. Panel probit marginal effects for the per capita Gross Domestic Product.

This pattern is similar for CO_2 emissions (Figure 2). In a first part, we observe that increasing the emissions also increase the probability to adopt FiT. Then, we individuate a turning point. Observing the Figure 2, we note that the CO_2 level at which decreases the ME is large.

Developing countries are more interested in economic development and growth and they do not consider the environmental impact of anthropogenic activities.

In Figure 3 we report the ME for the share of renewable generation. As expected, the ME increases as the share of renewable generation increases. Turning point is reached about at 40% of renewable generation. This share can be considered as the level at which a country reach a target level of RES generation, conditioned to the actual technologies.

The analysis of marginal effects has confirmed the basic idea. The adoption of FiT depends by a series of factors. The decisions underlying the adoption of the policy are many, but it highlights the dynamic nature of them.

Policymakers adopt this policy until they have reached threshold levels in GDP, in CO_2 emissions or in the share of renewable generation. Especially in the latter variables, it is clear that the probability of FiT adoption tends to grow until it reach a threshold level (as mentioned above of 40%) followed by a rapid reduction of the marginal effects. Therefore this level can be considered as the threshold limit within which policymakers have to encourage generation from renewable. Beyond this threshold level, this form of incentive can be revised, or even eliminated. The marginal effects of GDP and CO_2 emissions behave in a different way. They grow very quickly, but decreases much more slowly. This implies that the probability of adoption depends strongly on GDP and CO_2 emissions. But once the policy was adopted, these variables are secondary.

Countries adopt FiT as long as not reaching a high share of generation from RES confirming the relevance of this regulatory policy for the incentive to investments in RES.

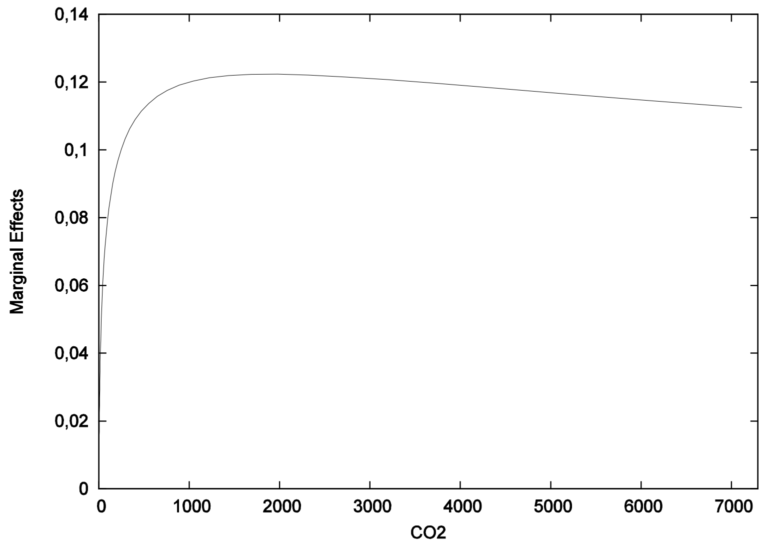

Fig. 2. Panel probit marginal effects for the total carbon dioxide emissions.

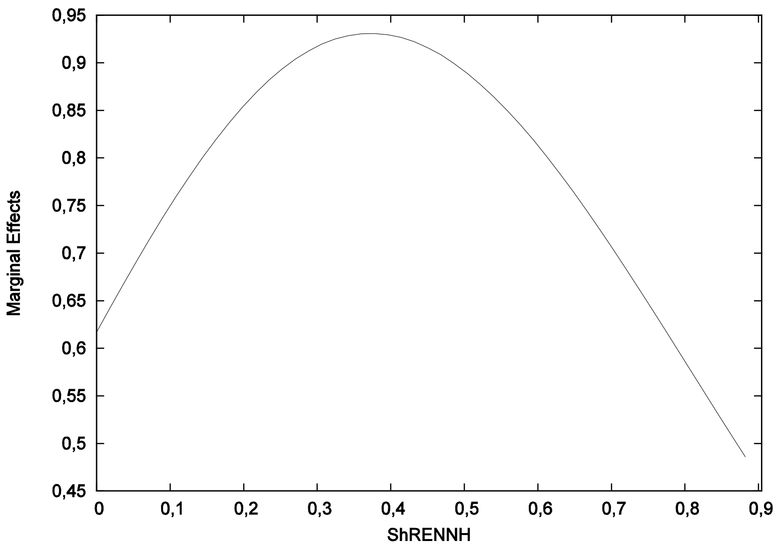

Fig. 3. Panel probit marginal effects for the share of renewable generation.

6. CONCLUDING REMARKS

This study has been developed with two primary aims: *i)* identify the variables related to the decisions of a country to adopt a regulatory policy as feed in tariff in order to promote the investments in RES and *ii)* individuate the turning point at which FiT can be dropped from the policy instruments employed to incentive the RES generation.

However, some limitations exist in this study. There is no very good source of data for policy indicators for all of the countries included in the sample. This did not allow controlling the effect of other promotion policies. The second limitation is that there did not take into account the intensity of the FiT among countries.

Variables included are significant on the decision to appeal to the incentive. In particular, the CO_2 emissions assume importance both as impact on the population of the level of pollution and as emissivity measure of the efficiency of the generation process in a country. In fact, the collapse in the price of RES observed in recent years, put forward the latter as a viable alternative to expensive plant system upgrades necessary to cut CO_2 emissions. The increasing in the probabilities to promote the electricity generation from RES that emerges from this model strengthens the evidence of the widespread use of energy policies oriented towards generating conversion from RES. In the same way must be interpreted the results related to Kyoto variable. Moreover, the economic growth is certainly one of the major causes of the FiT adoption. Increasing the level of GDP and increasing living conditions the countries try to introduce some policy incentives for promote the investments in RES. Also the results related to the electricity consumption in both models are in line with the theoretical aspects. With regard to the second aim, we observe that the probability to adopt FiT is related to the development stage of the countries, to their environmental impact and to renewable generation. FiT represents a useful policy for the promotion of RES generation but it is certainly not the only grant and it is not forever. Reaching a level of GDP, carbon dioxide emissions and renewable generation, countries could revise, or eliminate, this policy instrument. FiT confirms its nature. It contributes to promotion of investments in RES but it could be a temporary policy.

In future studies, the limitations summarized in this study should be overcome. In particular, more work should be done on topics such as what is the relationship of the other promotion policies on investments in RES, how important is the intensity of the promotion policies, in terms of financial resources provided and results obtained.

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