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How can favourable financing improve energy efficiency investments?

Evidence from new experimental data

European Investment Bank
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How can favourable financing improve energy efficiency investments? Evidence from new experimental data

Abstract

Promoting investment in energy efficiency has become increasingly important over the past decade. It is heavily discussed in the context of the EU 2021-2027 Multiannual Financial Framework, and at the core of the EU 2030 Climate and Energy Framework. While the budget allocation and the energy efficiency target have been well defined, less is known about effective ways to promote investments in energy efficiency. This paper sheds light on this issue by showing how effective financial instruments and technical assistance are in increasing investments in energy efficiency. Using new experimental data from the European Investment Bank, we find that a lower and fixed interest rate, a lower collateral requirement and the provision of technical assistance in the implementation of the project can significantly boost investment in energy efficiency. When combining these favourable conditions, the probability that firms invest in energy efficiency increases by more than a third. These results provide important insights into measures to increase energy efficiency investments, and how to optimally design them, which is key for EU policy-makers and lending institutions.

1. Introduction

Energy efficiency is about providing the same products and services with less energy use. It allows saving costs while reducing emissions of CO2 gases and other pollutants. With the 2030 EU Directive's goals of a 40% decrease in CO2 emissions, a 32.5% increase in energy efficiency and a 32% increase in the share of renewable energy by 2030, promoting investments in energy efficiency projects is essential to reach the long-term objective of curbing global warming. However, these investments will not happen at a sufficient scale on their own. This is because market failures triggered by imperfect information, positive externalities, and split incentives, in addition to some 'behavioural' mistakes; prevent investments at a socially optimal level (Allcott, 2017; Allcott and Greenstone, 2012; Gerarden et al., 2015; Jaffe and Stavins, 1994; Sutherland, 1996).

This raises the question from a policy perspective: what is the most effective way to boost firm investment in energy efficiency? The aim of this paper is to shed light on this question by using new experimental data from the 2018 European Investment Bank Group Survey on Investment and Investment Finance (EIBIS). The Survey includes an online module where 1,654 firms are asked whether they would go ahead or not with investing in a specific energy efficiency project, for which they are shown different project and financing offer characteristics, and the possible provision of technical assistance, all of which are randomly drawn. The methodology we use allows us to assess how a change in one of the characteristics or technical assistance influences firms' decision to invest in energy efficiency, and by how much. Measuring how characteristics of a financing offer and technical assistance can boost energy efficiency investments is particularly relevant for policy-makers, as the latter can influence these.

This work makes a valuable contribution to research on energy efficiency investments. First of all, our methodology overcomes obstacles of reverse causality and omitted variable bias often found in the literature. This is because all our variables are randomly drawn. Secondly, the data we use is unique, to the extent that it covers firms from all EU countries, sizes and sectors, and that it also provides additional information on the firms being surveyed. Last but not least, to the best of our knowledge, no other work has so far captured the responsiveness of firms to changes in the characteristics of financing offers and the provision of technical assistance in the context of energy efficiency investments.

The remaining part of this paper is organised as follows. First of all, we review the existing literature on the factors that influence investments in energy efficiency. Secondly, we introduce the EIBIS online module and data. Thirdly, the methodology and model are presented. Then, we discuss results. We conclude by summarising our findings and making policy recommendations.

2. Literature Review

The existing literature on investments in energy efficiency is limited, to the extent that it is more focused on what barriers to this type of investment are, rather than what can be done to boost these investments from a financial point of view. It identifies six general categories of barriers to this type of investment. These are imperfect information, hidden costs, risk, access to capital, split incentives and bounded rationality (Sorrell et al., 2011). These barriers trigger market failures that prevent socially optimal investments in energy efficiency.

The literature is also usually limited to SMEs that are in the manufacturing sector. For instance, in a paper on Northern Italian manufacturing SMEs, Trianni et al. (2013) find that information and economic barriers are the biggest obstacle to energy efficiency investments, and that this is especially true for firms with low productivity variability. Similarly, Fleiter et al. (2012) find that information is a barrier for German SMEs, and that higher investment costs and lack of capital prevent energy efficiency investments. These findings are consistent with Gruber and Brand's

(1991) work on German SMEs, where the authors find that lack of information and low priority prevent energy efficiency investment from being carried out. Looking at Swedish non-energy-intensive manufacturing SMEs, Thollander et al. (2007) identify the lack of access to external capital as one of the factors explaining the lack of investment in energy efficiency.

One paper that looks at how firms *respond* to different energy efficiency investment projects' characteristics, instead of focusing on barriers, is that on US manufacturing SMEs by Anderson and Newell (2006). They find that the probability that firms invest in energy efficiency is higher, the shorter the payback period, the lower the investment costs, the higher the annual savings, the higher the energy prices, and the higher the energy conservation. They also find that firms' responsiveness to initial costs is 40% higher than to annual savings, emphasising the higher effectiveness of subsidies compared to increases in energy prices when it comes to energy efficiency investments.

While there is evidence in the literature that characteristics of investment projects matter for energy efficiency investments, less is known about the effectiveness of support measures in stimulating more investment in energy efficiency, in particular when it comes to access to finance technical assistance. It is in this void that this research makes a significant contribution, by informing policy makers and lenders on *how* and *by how much* a favourable financing offer along with the provision of technical assistance can substantially boost energy efficiency investments in the EU. In addition, our data allows capturing firms from all economic sectors and from all sizes, unlike existing studies that focus on manufacturing SMEs. We introduce it in the next section.

3. EIBIS Data

The data used in our study comes from the online module of the EIB's Investment Survey of 2018. It is divided into four sections. The first one asks preliminary questions on support schemes and past experience with energy audits. The second section focuses on energy audits and different combinations of policy interventions. Section three looks at characteristics of energy efficiency investment projects combined with financing offers and technical assistance. The concluding section captures how firms assess energy efficiency investments to non-energy efficiency investments. The present paper only looks at section three.

The EIBIS is carried out annually and gathers quantitative and qualitative information on companies' characteristics and their performance, their past and future investment activities, their sources of finance, financing issues and other challenges that they might be facing, such as access to finance; amongst others. It was launched in 2016, with the aim of building a firm-level data set, in order to provide a representative view of the investment situation of firms in the 28

EU Member States. The information collected usually refers to the previous financial year of the companies.

The survey is based on a telephone interview (i.e. the general module) of 12,500 firms from the 28 EU Member States. Fieldwork is carried out by the intermediary of Ipsos-MORI. Following the telephone interview, companies are invited to take part in an online experiment. About 1,500 firms participated. The survey is in its third wave. The third wave of the online module, which is the one we use here, focuses on energy efficiency investments. The previous two waves were on firms' preferences for loans characteristics, and on the trade-off between equity and debt loan, respectively (Brutscher et al., 2017, Brutscher and Hols, 2018).

Firms are shown eight screens in total, with different combinations of characteristics of an investment project, a financing offer and the provision (or not) of technical assistance, all randomly drawn. This means that some combinations are more favourable than others. Based on the combination that they see, firms can decide between five possible outcomes. These are whether they would 'definitely go ahead', 'probably go ahead', 'might or might not go ahead', 'probably not go ahead' or 'definitely would not go ahead' with the investment project based what they are being shown.

The investment project is presented as the result of an energy audit. Its characteristics include the total investment cost, the annual cost saving in terms of energy usage, the corresponding internal rate of return and the corresponding payback period. The cost saving percentage is drawn from a uniform distribution ranging from 5% to 25% of the total annual energy spend declared by the firm in the first section of the same online module. Along with firms-stated energy costs, this allows to derive the total cost saving from the energy efficiency project. The internal rate of return (or IRR, ranging uniformly from 4% to 20%), together with the cost saving, leads to the overall project cost estimation. The payback period is calculated directly from the total project cost and the cost saving, and is inversely linked to the IRR.

With respect to the characteristics of the financing offer, these are the amount of the loan offered, the years of maturity, the interest rate and its type, and the collateral requirement. The loan amount is either 30%, 50%, 75%, 100% or 120% of the total investment cost. The maturity is either 50%, 75%, 100%, 125% or 150% of the payback period. The interest rate is either fixed or floating, and normalised around the mid-point for each country and loan size. In terms of the collateral, it is either nil or worth 20%, 40%, 60%, 80% or 120% of the loan amount. All values are measured in local currency, when appropriate. The provision of technical assistance in the project implementation is added as part of the financing offer.

While one could argue that one of the drawbacks of this research is the fact that the experiment is based on hypothetical characteristics of investment projects and financing offers, the experiment has been designed in such a way that it comes as close to reality as possible, as it is tailored around the firm's annual energy spend, and as interest rates have been normalised around their mid-points.

Figure 1 gives an example of one of the screens shown to a British firm whose annual energy spend is £1500. With respect to the characteristics of the investment project, the firm's annual cost saving is worth 25% of its annual energy spend (i.e. £375), with a proposed internal rate of return of 12% and a payback period of 6 years. In terms of the financing offer characteristics, the loan amount offered covers 50% of the total investment cost, with a maturity of 4 years, a fixed interest rate of 709 basis points, a collateral requirement of 60% and no technical assistance.

Below you can see an energy efficiency project with a particular project cost and annual cost saving, along with a financing offer that is linked to this project.
Please assume that you have undertaken an energy audit, and that the savings below come from that report.
Given the two elements, and taking them at face value, how likely are you to go ahead with the project under the given conditions?
Please Note - The project would necessarily come with this financing, and the financing cannot be used for anything else but the project.

Investment Project

Total Investment Cost / GBP	2,000
Annual Cost Saving in terms of energy usage / GBP	375
Corresponding IRR (Internal Rate of Return)	12%
Corresponding Payback Period	6 Years

Financing Offer

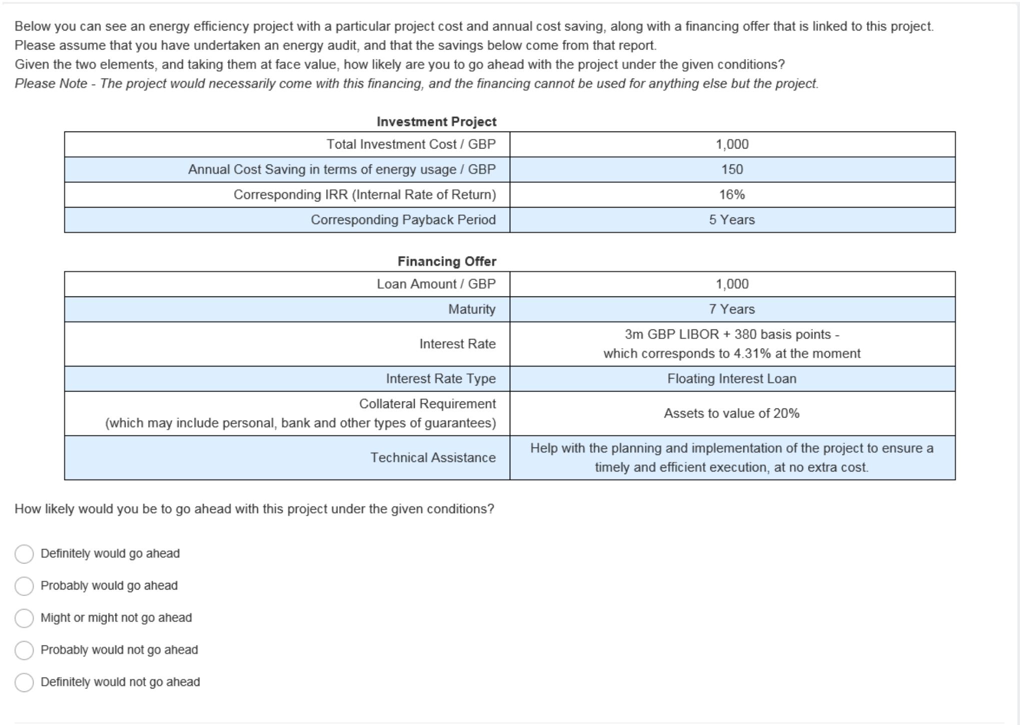
Loan Amount / GBP	1,000
Maturity	4 Years
Interest Rate	7.09 %
Interest Rate Type	Fixed Interest Loan
Collateral Requirement (which may include personal, bank and other types of guarantees)	Assets to value of 60%
Technical Assistance	None

How likely would you be to go ahead with this project under the given conditions?

- Definitely would go ahead
- Probably would go ahead
- Might or might not go ahead
- Probably would not go ahead
- Definitely would not go ahead

Figure 1. Screenshot of an example of specific investment project and financing offer characteristics presented to a British firm with an annual energy spend of £1500

Figure 2 shows an alternative screen presented to the same British firm. In this specific example, the firm's annual cost saving is worth 10% of its annual energy spend (i.e. £150), with a proposed internal rate of return of 16% and a corresponding payback period of 5 years. With respect to the financing offer, the loan amount offered covers 100% of the total investment cost with a maturity of 7 years, a floating interest rate of 380 basis points with a spread of 431 basis points, a collateral that equals assets to a value of 20% and technical assistance provided.



Below you can see an energy efficiency project with a particular project cost and annual cost saving, along with a financing offer that is linked to this project.
Please assume that you have undertaken an energy audit, and that the savings below come from that report.
Given the two elements, and taking them at face value, how likely are you to go ahead with the project under the given conditions?
Please Note - The project would necessarily come with this financing, and the financing cannot be used for anything else but the project.

Investment Project

Total Investment Cost / GBP	1,000
Annual Cost Saving in terms of energy usage / GBP	150
Corresponding IRR (Internal Rate of Return)	16%
Corresponding Payback Period	5 Years

Financing Offer

Loan Amount / GBP	1,000
Maturity	7 Years
Interest Rate	3m GBP LIBOR + 380 basis points - which corresponds to 4.31% at the moment
Interest Rate Type	Floating Interest Loan
Collateral Requirement (which may include personal, bank and other types of guarantees)	Assets to value of 20%
Technical Assistance	Help with the planning and implementation of the project to ensure a timely and efficient execution, at no extra cost.

How likely would you be to go ahead with this project under the given conditions?

- Definitely would go ahead
- Probably would go ahead
- Might or might not go ahead
- Probably would not go ahead
- Definitely would not go ahead

Figure 2. Screenshot of an example of specific investment project and financing offer characteristics presented to a British firm with an annual energy spend of £1500

In our analysis, we are particularly interested in measuring by how much variations in the interest rate, in its type, in the collateral requirement and in the provision of technical assistance change the probability that firms invest in an energy efficiency project of a particular type. This is because these are financial instruments that policy-makers and lending institutions can influence.

Table 1 shows the firm coverage by country, while Table 2 shows the firm coverage by sector and by size. A total of 1,654 firms were interviewed, meaning that there are 12,912 observations in total, as each firm is shown eight screens[1].

In terms of country coverage, almost one firm out of ten is Finnish, while 7% of the sample are Italian and another 7% are Dutch firms. Danish and Spanish firms each represent 6% of the sample. The least represented countries are Austria, Cyprus, Germany and Slovakia, with just 1% of firm coverage per country. When looking at sector coverage, over a third is in the manufacturing sector. The least represented sector is construction. With respect to size, almost half of the firms interviewed are small, and only a fifth are large (Table 2).

[1] In reality this number is a bit smaller, as not all firms went to the end of the online module.

	Frequency	Percent
Austria	14	1
Belgium	83	5
Bulgaria	69	4
Croatia	68	4
Cyprus	9	1
Czech Republic	43	3
Denmark	98	6
Estonia	43	3
Finland	139	8
France	61	4
Germany	19	1
Greece	49	3
Hungary	80	5
Ireland	34	2
Italy	118	7
Latvia	40	2
Lithuania	33	2
Luxembourg	25	2
Malta	38	2
Netherlands	120	7
Poland	73	4
Portugal	75	5
Romania	53	3
Slovakia	13	1
Slovenia	61	4
Spain	102	6
Sweden	53	3
United Kingdom	41	2
Total	1,654	100

Table 1. Coverage of firms by country in the experiment

	Frequency	Percent
Manufacturing	552	34
Construction	251	15
Services	433	27
Infrastructure	391	24
Small	739	45
Medium	606	37
Large	309	19

Table 2. Coverage of firms by sector and size in the experiment

4. Methodology and Model

We rely on a logit model with fixed effects. The dependent variable is the probability to carry out the investment in energy efficiency. The independent variables are (some variants of) the characteristics of the investment project, the financing offer's characteristics, and the possibility of having technical assistance. There are five possible answers to the question of whether or not the firm will go ahead with the investment in improvements of energy efficiency. To recall, these are: 'would definitely go ahead', 'would probably go ahead', 'might or might not go ahead', 'would probably not go ahead' or 'definitely would not go ahead'. For the sake of simplicity, we will assume that the two possible answers correspond to a 'yes', and the last three answers to a 'no'. This categorisation is based on a previous paper by Brutscher et al (2017)[2].

There are I firms indexed by i that can choose whether to go ahead with the project or not in each of the eight screens shown to them, which are indexed by $s = 1, \dots, 8$. Whether the project is carried out is indexed by $j \in \{no, yes\}$. Firm i's preferences can be represented by a utility function, as it is assumed that they meet the conditions of rationality. Preferences are assumed to be monotonic, where firms will always prefer more to less, implying a quasi-concave utility function.

Firm i going for project j from screen s has the following utility function:

$$u_{is}(j) = \alpha_i(j) \sum_{k=1}^{K} \beta_k x_{kis}(j) + e_{is}(j)$$

Where $k = 1, \dots, K$ is an index of the investment project and financing offer characteristics x, $e_{is}(j)$ is the unobserved utility function derived by firm i going for the project j, β_k is the coefficient that measures the effect of the characteristics k to utility and $\alpha_i(j)$ is a firm-specific and alternative specific fixed effect . Indeed, characteristics will affect utility differently, depending on whether the firm decided to carry out the project.

While it is not possible to determine utility from the data, it is still possible to identify firms' preferences for characteristics, such that:

$$y_{is} = \begin{Bmatrix} 0 & if & u_{is}(no) > u_{is}(yes) \\ 1 & if & u_{is}(no) < u_{is}(yes) \end{Bmatrix}$$

[2] Whether we put the answer 'might or might not go ahead' in the 'yes' or 'no' category does not alter our overall results. The same applies we if make our dependent variable categorical. For the sake of simplicity, we choose a binary outcome.

Where $u_{is}(no)$ is the utility derived from choosing not to go ahead with the project, while $u_{is}(yes)$ is the utility derived from going ahead with the project.

The unobserved part of utility, denoted $e_{is}(j)$, is type-I-extreme-value distributed, such that the probability to carry out the project, denoted $P(y_{is} = 1|x_{is})$, is given using the logit model with fixed effects in the following way:

$$P(y_{is} = 1|x_{is}) = \frac{e^{(\alpha_i(yes)+\sum_{k=1}^{K}\beta_k(yes)x_{kis})}}{e^{(\alpha_i(yes)+\sum_{k=1}^{K}\beta_k(yes)x_{kis})} + e^{(\alpha_i(no)+\sum_{k=1}^{K}\beta_k(no)x_{kis})}}$$

The model can only be identified by normalising the coefficients under one alternative. Hence, the coefficient of the utility function under the alternative $j = no$ is set to zero, such that $\alpha_i(no) = \beta_k(no) = 0\ \forall k \in K$. The logit model can be rewritten as such:

$$P(y_{is} = 1|x_{is}) = \frac{e^{(\alpha_i(yes)+\sum_{k=1}^{K}\beta_k(yes)x_{kis})}}{e^{(\alpha_i(yes)+\sum_{k=1}^{K}\beta_k(yes)x_{kis})} + 1}$$

As this study is concerned with the marginal effect of different characteristics on the probability to carry out the project, we can write the elasticity of the project being carried out according to characteristics k such that:

$$\rho_k(x) = \frac{\partial P(y = 1|x)}{\partial x_k} = \beta_k(yes)P(y = 1|x)(1 - P(y = 1|x))$$

All characteristics are randomly drawn, overcoming the potential problem of reverse causality and omitted variable bias in the model.

Our model looks as follows:

$$y_{is} = \alpha_i + \beta_1 x_{1is} + \beta_2 x_{2is} + \beta_3 x_{3is} + \cdots + \beta_n x_{nis} + \gamma x_{2is} x_{3is} + u_{is}$$

In total, we consider nine independent variables($n = 9$), which are either characteristics or variants of the characteristics as they appear in the module's screen. Two of them are linked to the investment project, Six are related to the financing offer, and the final one is whether technical assistance is provided. We include one interaction term as part of the financing offer variables. The interaction is between a continuous (i.e. interest rate) and a dummy (i.e. whether it is fixed or floating) variables, denoted as $\gamma x_{2is} x_{3is}$. Our dependent variable y_{is} represents the binary outcome where 1 is 'yes' and 0 is 'no', as an answer to the question on whether to carry out the energy efficiency investment for firm *i* with screen *s*.

Our first variable is linked to the project investment cost and to the firm's annual energy spend, which firms are asked about in the preliminary section of the online module. It measures the ratio of the project investment cost over the annual energy spend. The variable is continuous and a percentage share. It is used as a proxy for the size of the project. The total investment cost is chosen over the annual cost saving in the investment project's characteristics, as we assume that firms are more concerned with the immediate costs of their investment rather than the long-term savings. This is consistent with findings by Anderson and Newell (2006) highlighted above. We expect higher costs relative to the firm's annual energy spend to have a negative impact on the firms' willingness to carry out the investment.

The second variable is the internal rate of return. It uniformly varies between 4% and 20%. The rate of return and the payback period are inversely linked, so using one or the other does not alter our results. The values of the payback period uniformly vary from 8 to 4 years, corresponding to the values of the internal rate of return[3]. We expect a higher internal rate of return (i.e. a lower payback period) to have a positive impact on the firm's willingness to go ahead with the investment.

The third variable in our model is linked to the loan amount, as part of the financing offer. Here again, instead of considering the characteristic on its own (i.e. the loan amount), we put it into perspective by looking at its share over the total investment cost. It is expressed as a percentage share and indicates how much of the project cost is covered by the loan. This coverage varies from 20% to 200%[4]. The expectation is that the higher the share of the loan amount covering the investment cost, the more likely firms are to invest.

A variant of the maturity is our fourth variable. Using a binary variable, we consider whether the maturity is above or below the payback period[5]. The variable takes the value 1 if the maturity is above or equal to the payback period, and 0 if the maturity is below. We do not include the maturity as a single variable, but rather relative to the payback period, as firms would assess it against the period of payback of their investment. We expect the probability of firms investing to be higher when the variable is equal to 1.

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[3] The investment cost announced to firms in the details of the project is also a function of the internal rate of return and of the payback period. For each internal rate of return and corresponding payback period, a total investment cost multiplier is given, which will determine the link between the total investment cost and the annual cost saving. This multiplier varies uniformly from 4 to 8. Its ascending values correspond to the ascending values of the internal rate of return and to the descending values of the payback period. For example, if the internal rate of return is equal to 8%, the payback period will be 7 years and the total investment cost will be equal to seven times the annual cost saving. As all these variables are inter-connected.

[4] Once the values in local currency have been rounded.

[5] The maturity can take the values 2, 3, 4, 5, 6, 7, 8, 10 or 12 years, and the payback period is either 4, 5, 6, 7 or 8 years.

Three of our variables are measured around the interest rate. The first one is a dummy taking the value 1 when the interest rate is fixed and 0 when it is floating. The second variable is the actual value of the interest rate, which is normalised around the benchmark values (i.e. is indexed around the normalised values)[6]. It is measured in basis points. The third variable is an interaction between the dummy and the continuous interest rate variable. We expect to see the probability of firms investing going up when the interest rate is fixed and when the interest rate goes down.

The eight variable included in our model is the collateral requirement as it is. A higher collateral should diminish the firms' willingness to carry out the investment. The last variable of our model that has been included in the financing offer is whether technical assistance in the project implementation is provided. The variable is a binary that takes the value 1 if technical assistance is provided, and more specifically if there is 'help with the planning and implementation of the project to ensure a timely and efficient execution, at no extra cost', and 0 if there is no technical assistance in the offer made. We expect firms to prefer receiving technical assistance, rather than having none. The next section presents our results.

Results

How investment decisions and project characteristics relate

The two variables related to the investment project characteristics are the percentage share of the investment cost over the annual energy spend (i.e. a proxy for the size of the project) and the internal rate of return. Results show that if the investment cost goes up by 10 %, the probability that the firm invests in the project decreases by 0.6 pp. This is because firms care about the money that they have to spend immediately, and also relative to other expenses. This coefficient remains relatively low, as firms are more concerned with the internal rate of return and the payback period when doing an investment, rather than its cost, as eventually returns will cover them over time.

With respect to *changes* in the internal rate of return, a 1 pp increase will raise the probability that the firm goes ahead with the investment by 2.5 pp. An increase in the internal rate of return implies a decrease in the corresponding payback period. This payback period is equal to the ratio of the investment cost over the cost savings, as it is the period needed for the firm to get the money it invested into the project back. We only included one of the two variables in order to avoid issues of multicollinearity. As Figure 3 shows, the relationship between the probability to

[6] The benchmark values vary for fixed interest rates depending on the loan size and the years of maturity, and for floating ones but only depending on the loan size.

carry out the project and the payback period is linear[7], and the probability of carrying out the investment project decreases as the payback period increases, other things held equal.

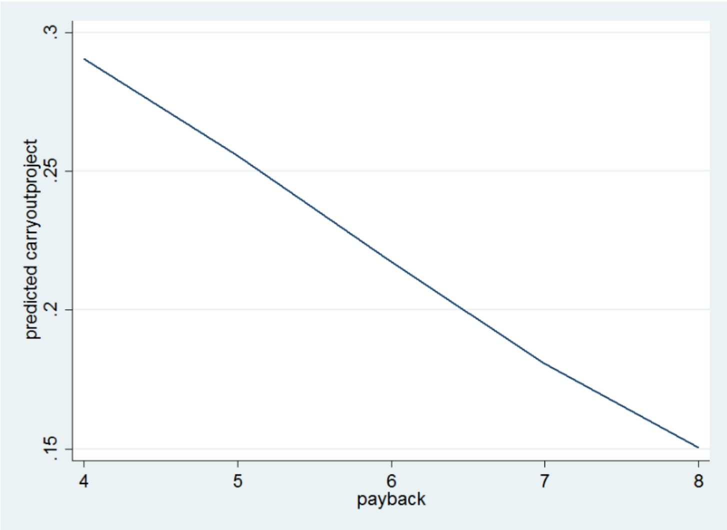

Figure 3. Probability of carrying out the project versus the payback period in years

Based on results from the online experiment, we can deduct how the probability that firms are willing to invest in a project changes with the internal rate of return (IRR) of a project, *ceteris paribus (*Figure 4). When the IRR is equal to 4%, the probability that firms invest is 39%. If the IRR increases to 20%, this probability goes up to 77%. The rate above which firms are indifferent between investing and not investing, also known as the hurdle rate, is slightly above 8%.

To put these IRR values in a comparative perspective, the existing literature shows that the IRR for energy efficiency investments varies from 10% to 25%, with a calculated average of 17% (EnergyStar, 2007; Farrell and Remes, 2008; Intelligent Energy Europe, n.d.), meaning that the implied investment probability ranges between 54% and 88%.

[7] This differs from findings in Anderson and Newell (2004) who found that the relationship was non-linear and hence included a quadratic term for the payback period.

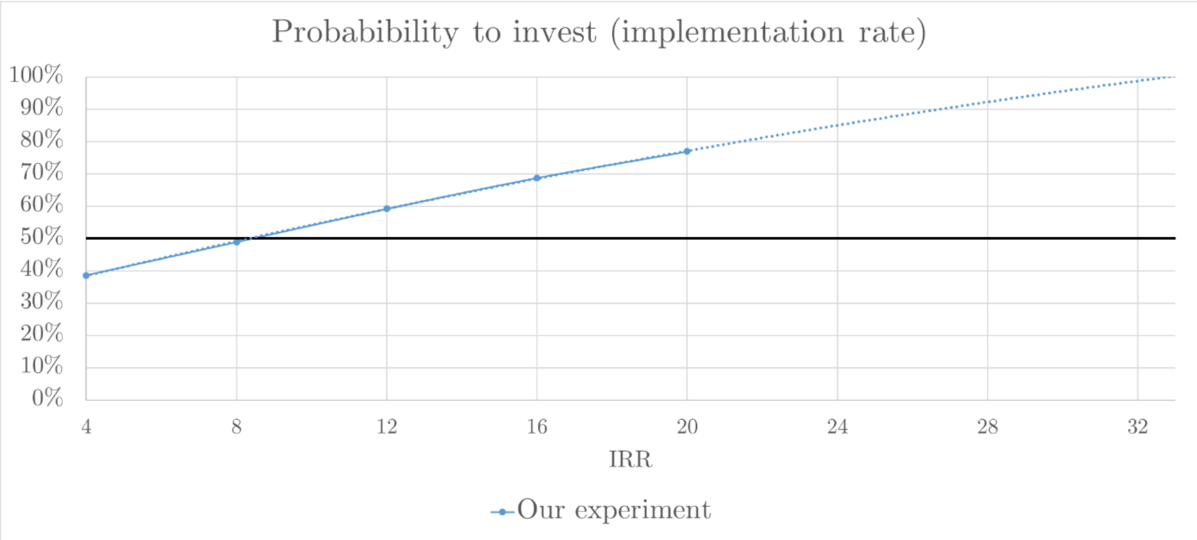

Figure 4. The relationship between the internal rate of return and investment probabilities

In sum, our findings show how firms' willingness to invest in energy efficiency projects varies with the return/payback period for these projects.

In the next section, we look at how – holding constant these project characteristics – offering favourable financing conditions and technical assistance in the implementation of these projects can help to further boost investment probabilities

How a favourable financing offer can boost energy efficiency investments

Results on the characteristics of the financing offer show that firms care about the loan amount they receive relative to the project investment cost (see Table 3). If the loan amount increases by 10 %, the probability that firms go ahead with the project will increase by 0.5 pp.

If the fixed interest rate decreases by 100bp, the probability increases by 8pp (or 13% for a typical investment project[8]), by contrast to 5pp (or 8%) if it were floating. This shows that firms are more sensitive to changes in the fixed interest rate than in the floating one, which has to do with the fact that firms care more about the longer run and are more risk-averse. Another term that matters is the collateral requirement coming with the funding offer. For each 20%-decrease in the collateral assets' value, the probability of investing increases by 2.5pp (or 4%). Firms seem to be indifferent to whether the years of maturity are above the payback period.

[8] A typical investment project is one where all variables are set to their mid-points. The average investment probability equals 60% under these conditions.

Taken together, our results suggests that a favourable financing offer situation where the interest rate is fixed and 100bp less than the mid-market offer, and where the collateral requirement is 20% as opposed to 60%, can boost investment probabilities by more than a third (i.e. 33%).

We were also able to make estimates for sub-groups, thanks to the matching of our experimental data to the EIBIS general survey data (see the Appendix). In terms of the financing offer, estimates show that infrastructure and manufacturing firms are more sensitive to whether the interest rate is fixed or floating, compared to firms in construction or services. With respect to the collateral requirement, services firms are more sensitive to its value, by contrast to manufacturing firms. SMEs are more sensitive to the collateral requirement, compared to large firms.

	(1)
VARIABLES	Go ahead with the project
Project size	-0.000597***
	(0.000201)
Internal rate of return (IRR)	0.0251***
	(0.00128)
Loan size	0.000524**
	(0.000229)
Maturity above payback	0.0198
	(0.0159)
Fixed interest rate	0.106***
	(0.0242)
Fixed interest rate index	-0.00115***
	(0.000179)
Interest rate index	-0.00126***
	(0.000146)
Collateral	-0.00125***
	(0.000217)
Technical assistance	0.0304**
	(0.0153)
Observations	6,274

Standard errors in parentheses
*** p< 0.01, ** p< 0.05, * p< 0.1

Table 3. Logit regression outputs of the probability that firms invest on the investment project and financing offer characteristics, and technical assistance[9]

[9] The number of total observations has significantly dropped because when using conditional fixed-effects logistics regression analysis, variables that show no variation across the id variable are automatically dropped.

How providing technical assistance can boost energy efficiency investments

Assisting in the implementation of the project with technical expertise is also effective in increasing the probability that firms invest in energy efficiency. If provided, it increases the probability that firms invest in the project by 3pp (or 5%), other things held constant. Manufacturing and large firms are particularly more responsive to the provision of technical assistance. Technical assistance can mean establishing baseline studies or simply help in project implementation.

Conclusions and Policy Implications

Tackling climate change and global warming have become increasingly central to governments and policy-makers' agendas. Increasing investments in energy efficiency plays a key role in this respect. The EU has already allocated some of its annual budget to this type of activity and set an energy efficiency target for 2030. However, little is known about the most effective ways to allocate this budget and to reach the self-imposed targets.

This is where our work aims to add value. By using EU firm-level data from a new online experiment, we unveil firms' investment responsiveness to financial incentives and technical assistance when it comes to investing in energy efficiency. Specifically, we measure and quantify the effect of a series of financing characteristics (such as interest rates, collateral requirements, loan maturities) in increasing the probability that firms invest in energy efficiency. We do this while controlling for differences in project characteristics (such as the IRR and payback period).

We find that a favourable financing offer can increase the likelihood that firms invest in energy efficiency projects by as much as 33%- which comes close to the 2030 EU Directive target of a 32.5% increase in energy efficiency investments by 2030. These findings have important implications for both policy-makers and for lending institutions, such as the EIB insofar as they help to better tailor financial instruments and projects, and thereof promote more policy interventions.

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Appendix

	(1)	(2)	(3)	(4)
VARIABLES	Manufacturing	Construction	Services	Infrastructure
Project size	-0.000697**	0.000226	-0.000799*	-0.000835**
	(0.000315)	(0.000531)	(0.000430)	(0.000423)
Internal rate of	0.0229***	0.0194***	0.0267***	0.0273***
return (IRR)	(0.00212)	(0.00559)	(0.00350)	(0.00294)
Loan size	0.00114***	-0.000138	-0.000302	0.000402
	(0.000308)	(0.000686)	(0.000503)	(0.000496)
Maturity above	0.0116	-0.0317	0.0661*	0.0104
payback	(0.0224)	(0.0462)	(0.0346)	(0.0344)
Fixed interest	0.109***	0.0931	0.0170	0.199***
rate	(0.0317)	(0.0738)	(0.0549)	(0.0567)
Fixed interest	-0.00130***	-0.000675	-0.000772*	-0.00131***
rate index	(0.000247)	(0.000557)	(0.000415)	(0.000427)
Interest rate	-0.000813***	-0.00188***	-0.00168***	-0.00132***
index	(0.000214)	(0.000360)	(0.000281)	(0.000309)
Collateral	-0.000669**	-0.00161***	-0.00123***	-0.00226***
	(0.000305)	(0.000568)	(0.000450)	(0.000485)
Technical	0.0355*	-0.0130	0.0460	0.0163
assistance	(0.0215)	(0.0446)	(0.0335)	(0.0331)
Observations	2,402	799	1,499	1,458

Standard errors in parentheses
*** p< 0.01, ** p< 0.05, * p< 0.1

Logit regression outputs of the probability that firms invest on the investment project and financing offer characteristics, and technical assistance by sector

	(1)	(2)
VARIABLES	SMEs	Large
Project size	-0.000702***	-0.000270
	(0.000227)	(0.000337)
Internal rate of return (IRR)	0.0223***	0.0270***
	(0.00174)	(0.00437)
Loan size	0.000408	0.000677*
	(0.000273)	(0.000358)
Maturity above payback	0.0101	0.0405
	(0.0189)	(0.0252)
Fixed interest rate	0.100***	0.105***
	(0.0292)	(0.0367)
Fixed interest rate index	-0.00118***	-0.000844***
	(0.000215)	(0.000290)
Interest rate index	-0.00121***	-0.00123***
	(0.000150)	(0.000373)
Collateral	-0.00140***	-0.000773**
	(0.000244)	(0.000381)
Technical assistance	0.0191	0.0504**
	(0.0182)	(0.0242)
Observations	4,773	1,501

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Logit regression outputs of the probability that firms invest on the investment project and financing offer characteristics, and technical assistance by size

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