The price of Spain's electricity increases twelve times more during natural gas shortages

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Researchers at the UOC's Finance, Macroeconomics and Management (FM2) group, which is led by Jorge M. Uribe, together with Stephania

Mosquera, a member of faculty from EAFIT (Escuela de Administración, Finanzas e Instituto Tecnológico) University in Colombia, have designed a statistical model that shows the extent of the knock-on effect of gas price changes on electricity prices in periods of relative electricity generation scarcity or abundance.

"This rise in electricity prices can be explained to a great extent by the historic peaks in international natural gas prices that we are seeing, which are in turn driven by higher actual demand from Asian countries as they leave the negative economic effects of the pandemic behind," explained Uribe, who is also a member of the UOC's Faculty of Economics and Business.

When demand for electricity cannot be initially met with greener sources, thermal power plants make their capacity available to the market. According to Uribe, although they are much less efficient at generating electricity than renewable sources, these plants are currently necessary to enable the system to guarantee a supply of electricity to anyone who needs it, preventing the terrible consequences that would otherwise arise for the welfare of both people and the economy.

The question is whether the current rises in electricity prices are a temporary phenomenon or a permanent feature of the market. This is not an easy question to answer, as it relies on factors in the fields of politics, technology, economics and climate. "These are all very complex systems when taken on their own, and it goes without saying that this complexity and difficulty of analysis are greatly increased when looked at together, something that has to be done in order to understand the electricity market. However, we can analyze the available data to get a preliminary idea of what can be expected in the future," he said.

Uribe explained that the new model, which involves a set of indicators relating to market prices and a variety of climate variables, makes it

possible to establish the natural-gas-to-electricity price transmission ratio in periods in which electricity is relatively "cheap" and in those in which it is relatively "expensive". The group of researchers analyzed electricity market data from 13 European countries over 10 years (from 31 March 2011 to 3 September 2021), as well as data from the Henry Hub general natural gas price index.

"We've noticed that, if the result of the formula is a number greater than one, this means that the price of natural gas has a greater effect on the price of electricity when the latter is expensive than when it's cheap," stated Uribe. "If the relationship between the two prices always remained the same regardless of the price of electricity, a future reduction in natural gas prices would be enough to see a proportional drop in electricity prices," he added.

However, the effect of natural gas on electricity varies greatly between the countries under analysis based on whether they are markets with relatively scarce or abundant electricity generation. In other words, in the countries under analysis, changes in gas prices do not have such a serious knock-on effect on electricity prices in these two market scenarios. Some countries are particularly vulnerable due to the configuration of their electricity markets. Such countries not only suffer from much higher electricity prices during periods of insufficient electricity generation but also do not conversely enjoy a proportional drop in electricity prices during times of gas abundance and stocking up.

The configuration of the Spanish and Portuguese electricity markets results in a more unstable relationship between prices

According to estimates, the figure for Spain is 12.4, which is the result of dividing the effect of natural gas on electricity when the latter is

expensive (this effect is 7.35) by the effect when it is cheap (this effect is 0.59). "This ratio clearly shows that the price is more greatly affected upwards (when prices tend to be high) than downwards (when prices tend to be low). The knock-on effect is 12.4 times greater when electricity is expensive. In other words, in markets with abundant electricity generation, the rises are never offset by falls by the same proportion," warned Uribe.

This ratio is greater than one for almost every country included in the sample, but with huge variations ranging from Finland's 0.8 to Portugal's record 18.6. In fact, applying the proposed models provides a warning regarding the need to gain a better understanding of the price formation mechanisms of the Iberian peninsula's electricity market, which have the highest ratios by far, and about the need to advance public policies that protect the most vulnerable electricity consumers from the types of unwanted economic consequences we are now seeing.

"In a 'marginalist' pricing system such as the one used in Europe's electricity markets, and specifically in Spain, it's the most costly and inefficient generation that ultimately determines the price paid to all sources of generation. This means that, to the extent that thermal power plants pass on the extra cost resulting from higher natural gas prices to the price of the power generated by them, the electricity prices paid by households will be directly affected by the price of natural gas," explained the expert.

This is key, particularly if you consider that, in fact, upward pressures on electricity prices tend to increase in the short term due to the energy transition towards greener energy sources that European countries are currently immersed in and that can no longer be delayed. Such pressures will be accompanied by the EU common regulatory framework's restrictions on CO_2 emissions, which will become greater and lead to similar dynamics to those seen since late 2020 in the prices of pollutant

gas emission rights, which have also reached historic highs after remaining stable for decades. It will be precisely thermal power plants that will be more seriously affected by this excess cost, as they require these rights in order to operate.

Nord Pool, an example of electricity market integration

The results of the FM2 group's research suggest we should explore other forms of market organization that are more interconnected both physically and economically and regionally and internationally. "See, for example, how the price transmission ratio for the countries forming part of Nord Pool, Europe's most integrated market, which include Denmark, Sweden, Norway, Latvia, Lithuania, Estonia and Finland, is usually lower than for other countries," noted Uribe.

The Nordic markets have much more stable price ratios in cases of different market configurations than Portugal and Spain. "This is because the more highly integrated markets lead to a better coordination of supply and demand and help mitigate the external shock effects of the fossil fuels imported by Europe," he noted.

It appears that market integration will be key to understanding price formation mechanisms in the Spanish electricity market and the design of public policies to protect the most vulnerable from any adverse effects in these markets.

Above all, these results suggest we should reconsider the government's important role in ensuring a smooth energy transition with voters' support, a necessary requirement for its sustainability. "In fact, we should not be shocked that more expensive electricity is how the world has to operate in the short term in order to do so more sustainably

until we can come up with more efficient ways to store energy than those currently available. However, even in this extreme scenario, the transition towards this new, more sustainable world must always minimize the impact on the most disadvantaged people in society, who in this case are precisely the ones least able to protect themselves from the adverse effects of inflation and the rise in electricity prices," concluded Uribe.

More information: Research paper: www.ub.edu/irea/working_papers/2021/202117.pdf

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