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PRICES IMPACT ON ENERGY DEMAND

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Overview

Understanding the reaction of energy demand to prices is an important issue today. The oil crises have shown it was possible to save energy and to change the mix of energies used.

The reaction of the consumers can be very difficult to understand and to model. First of all they do not only react to prices. They are aware of technology changes, equipment, and policies and may have environmental considerations, which all have an impact on their demand. They do not react immediately to these different changes, they must anticipate to decide whether a change of habit or an investment may be profitable. Moreover they may not consider the prices as continuous and adapt their consumption proportionally to the variations of prices. The reaction of energy consumption to prices is thus complex and difficult to sum up in a few equations.

Several approaches are possible to try to understand the relations between prices and demand in energy. We will focus on in this paper on translog model, our final aim is to estimate direct and substitution elasticity to prices

Methods

The translog function is an approximation of a function of production on an unknown point. It has been obtained by a Taylor development. Its form has progressively been modified so as to consider more cases. We will use an expression that allows considering the effect of the time (the trend) and the revenue on the total spending of energy (C).

$$\ln(C) = C_o + \sum_i C_i \ln p_i + \frac{1}{2}\sum_i \sum_j B_{ij} \ln p_i \ln p_j + R_o \ln Y + \sum_i R_i \ln p_i \ln Y + \sum_i A_i \ln p_i \times t$$

Where Y is the revenue, t the time (in years), p_i the prices of the different energies, i being electricity, oil, gas or other energy and coal, and C_o a constant variable, C_i, B_{ij}, R_o, R_i, and A_i the parameters associated with the former variables.

The results of the estimation of the model, do not give directly the links between consumptions and prices. Hence we need to make more calculations and it will remain impossible to predict the consumptions without making some hypothesis on the global cost and the total consumption. Actually the translog model is only a substitution model that explains the distribution of energies in the spending for energy.

We used the estimators to calculate price elasticity. In order to verify the stability of estimated elasticity we calculated confidence intervals with a double bootstrap method.

Results

We have tested our models on annual data on residential and industrial sectors in France.

The estimation of the model gives convincing results. The estimated market shares are very close to the real market shares. We calculate price elasticity and then estimate confidence

intervals with Bootstrap. We chose a 90% probability for the elasticity to be in the interval. The results follow.
In the industrial sector there is a certain rationality in actors' behaviour. Behaviour differ depending on energy source. Oil price elasticity is negative in the beginning of 80's, then null, maybe because its consumption has been compressed or substituted where possible. For gas and electricity, elasticity is slightly negative (respectively –0.4 and –0.2). For cross elasticity, we note complementarities between gas and electricity.
In household sector behaviour is less rational and actors' reaction is weaker. A reason could be that household consumption is less compressible and technology changes, necessary to change consumption profiles, take long time. Elasticity for electricity is slightly positive. This may be explained by the fact that in the past there has never been a price spike. For oil, on which price variations were tangible, elasticity is significantly negative.

Conclusion

In conclusion, our model allows to understand some links between the demand of energies and the prices. It does not consider any volume aspect but it gives the substitution possibilities between two energies. The application to the residential and industrial sectors in France shows the differences between the sectors. It seems the households are mostly sensitive to the price of oil when the industries take into account all prices. However in both sectors: the consumption of oil only reacts to the increases of its price and thus it does not grow again when the price decreases. Gas and electricity are complementary but may become substitute. We believe an improvement of this work would be to use data specific to a usage and a location.

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