How Do Oil Shocks Impact Energy Consumption? A Disaggregated Analysis of the U.S.

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Executive summary

This study aims to analyze the impact of three different types of oil shocks on renewable and non-renewable energy consumption based on monthly data from 1974 to 2018. Our case study is the U.S. because this country is currently the biggest oil producer and one of the most attractive countries in renewable energy. Thus, understanding the interaction between oil shocks and energy consumption is of interest for policy makers seeking an optimal energy mix strategy. The contributions of the paper rely on the disaggregation of both oil shocks and energy sources. Indeed, oil shocks are disaggregated to three levels: oil supply shocks, aggregate demand shocks and oil-specific demand shocks according to the Kilian (2009) method. The disaggregation of energy consumption is possible thanks to detailed information provided by the U.S. Energy Information Administration (EIA). This double disaggregation is important because oil shocks from the supply or demand sides do not have the same impact on the economy and each energy source requires a different production process. For this reason, we analyze seven different energies which are hydropower, geothermal, wood, waste for renewable energy consumption, and coal, natural gas and petroleum for non-renewable energy consumption. Our empirical methods consist of investigating how each category of energy consumption responds to oil shocks and how oil shocks spillover to energy consumption. For that, we rely on the impulse response functions estimated from a SVAR model and the dynamic connectedness measure proposed by Diebold and Yilmaz (2014). Finally, the time-varying estimates of these two measures constitute another important contribution of our study.

Our results show that the three kinds of oil shocks have different impacts on energy consumption. Indeed, wood and waste energy consumption respond the most to oil shocks. On the other hand, hydropower receives the highest spillover from oil shocks. We also find that aggregate demand shocks spillovers the less on energy consumption. This result suggests that oil supply and demand shocks have a higher impact on energy consumption than aggregate demand shocks. Thus, policies related to the aggregate demand may not have significant impacts on renewable energy consumption, except for biomass energy consumption. With non-renewable energy consumption, petroleum consumption behaves differently to oil shocks, compared with coal and natural gas consumption. Indeed, petroleum responds significantly to oil supply shocks while coal and natural gas consumption respond significantly to aggregate demand shocks. This result suggests that policies related to the aggregate demand of the economy has a high impact on natural gas consumption while oil supply and demand shocks have significant impacts on petroleum consumption. Furthermore, oil shocks spillover more on petroleum than on coal and natural gas consumption. Thus, policies related to the oil market would be more

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efficient in the reduction of petroleum consumption than that of coal and natural gas consumption. Finally, we would suggest using policies related to the aggregate demand of the economy to adjust the consumption of biomass, coal and natural gas consumption while using policies related to oil supply and demand to adjust the petroleum and hydropower energy consumption. Furthermore, the time-varying analysis shows that the number of energy policies and the existence of economic crises tend to intensify the interaction between oil shocks and energy consumption.

In the context of climate change accompanied by a higher population on earth, the energy demand will be increasing in the future. Responding to this energy demand is an important question in all the countries and the transition to alternative energies is attracting a high attention of policy makers, academics and the population. This study has indicated the importance to mobilize adequate macroeconomic policies related to the aggregate demand, oil supply or oil demand is of great importance because they would impact renewable and non-renewable energy consumption differently. Furthermore, it is important to study closely the impact of these policies on each kind of energy which responds to them differently. However, natural resources and political considerations of energy policies can be different in different regions and countries. That is why we would suggest the application of this research method at a regional level in the U.S. as well as in other countries to be able to recommend precise and appropriate policies.

Keywords: Disaggregated oil shocks; Disaggregated energy consumption; SVAR; Dynamic connectedness; U.S.
JEL codes*:* Q2; Q4.