ENERGY, RENEWABLE ENERGY AND GROWTH: EVIDENCE FOR BSEC COUNTRIES

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Overview

In recent years, politics of many countries focused on reducing energy consumption and on enhancing the deployment of renewable energy sources (RE) within the energy sector. This follows higher awareness for environmental issues, particularly climate change, the following need to reduce carbon emissions and to some extent the intention to reduce dependency on fossil fuel imports and vulnerability to rising fuel prices.

This development has drawn the attention of economic research, as there might be several economic consequences of such policies. One important potential consequence might be the effect of such policies on economic growth, in two aspects: One focuses on the linkage between energy consumption and growth: Several studies have shown that energy use might be an input factor for the growth function. If this is true, policies that aim at reducing energy consumption might have a negative consequence for growth. So far, there is no consensus on this question in academic literature.

The second aspect is the potential effect of renewable energy use on growth. Although several studies investigated this potential nexus in recent years, theoretical foundation why the source of energy should matter for growth is not really elaborated. One potential reason for such an influence could be that renewable energy sources need higher initial investments, while operating costs are low. Those investments might tie up capital that is then not available for other, perhaps more profitable investments. If this assumption holds, this would suggest a negative impact of investments in renewables on growth, and this effect should occur when capacity for renewables is expended. On the other hand, studies have shown that investing in renewables might enhance growth, in the form of jobs and private sector development This would suggest a positive impact running from renewables.

Following those considerations, I investigate the relationship between output, energy use and renewables for BSEC countries, using a neoclassical production function with capital and labor as additional variables explaining the output. In this specification, I found a positive linkage between energy use and output respectively growth for most BSEC countries; exceptions are Azerbaijan and Georgia. Regarding renewables, there is no negative relation, that I assumed initially, for most countries. Contrary, if growth and renewables are linked, the relation is positive. Here again, I found two exceptions, Albania and Turkey. In both countries, an expansion of installed renewable capacity negatively affects growth.

Methods

I decided to stay with OLS estimations for individual countries and for a panel with country fixed effects and standard errors clustered on country level. I considered testing for cointegration and using VAR or VEC models, but reviewing the data and testing the specification of those models let me discard this idea: Unit root tests show that the used variables are not all integrated of the same order, and several post-estimation tests for VAR and VECM estimations showed that those models are non-reliable in my context. Therefore, I decided to stay with OLS models.

I estimated the coefficients for a neoclassical production function with capital, labor, energy use and then either electricity generation from renewable sources, the share of renewable generation in total electricity generation, installed capacity for generation from renewable sources or its share in total installed capacity as inputs. This production function is estimated in first difference, using logarithms of the variables (except the shares), so that in fact economic growth is explained by changes of the inputs.

Causality is addressed by specifying the model with lagged variables explaining present outcomes, both for energy, renewables and the output. Hence, if I identified a significant relationship between output and energy or output and

renewables, I estimated one equation where growth is explained by lagged energy or lagged renewables, and one equation where energy or renewables are explained by lagged growth.

I performed some robustness checks to control if the results are influenced be collinearity between energy use and renewables or by positive effects on growth that are proxied by renewables. Those robustness checks change the results only for Turkey (see section “Results”).

I used data from Penn World Tables (Output, Capital, Labor), World Development Indicators (energy use) and US Energy Information Administration’s database (renewable electricity). All variables were used in per-capita values to eradicate the different size of BSEC countries.

Results

The results show that the hypothesis of a negative effect running from renewable capacity to growth is confirmed for two countries, Albania and Turkey; for the latter only if one uses expenditures for research and development as additional variable in the production function, as specified in one robustness check. For all other countries and for the panel grouping all countries, there is either no or a positive relation between renewables and growth: The latter, regarding generation, for the panel and for Georgia, Moldova, Armenia, Greece, Russia and Ukraine (for the latter four only if one uses the share of renewable generation) and regarding capacity, for the panel and Greece (both only for the share). In the panel, causality seems to run from renewable generation to growth, while growth causes an increase of the share of installed renewable capacity.

Energy use is positively linked with growth for most countries in the region; exceptions are Azerbaijan and Georgia. For Ukraine, the test with lagged variables suggest causality running from energy to growth, while for the panel and Turkey, the result suggests bi-directional causality. For Armenia and Serbia, causality seems to run from growth to energy use. For all other countries, lagged variables are not significant in both specifications.

Conclusions

According to my results, economic growth and energy use are closely linked in most BSEC countries, except Azerbaijan and Georgia. The test for causality I performed is ambiguous. It seems that growth and energy use develop parallel, but one cannot identify which of the two causes the other to move. In some way, this suggests a bi-directional relationship. For Turkey and the Ukraine, there is evidence that causality is running from energy use to growth. The same evidence shows up for the panel.

Regarding renewable electricity, I could not confirm the initial hypothesis that expansion of renewable capacity might have a negative effect on growth, as investments in renewables might tie up capital. Quite contrary, there is a positive relationship between renewable electricity and growth for several countries. For the panel, causality is suggested to run from renewable electricity generation to growth. For Armenia, causality seems to be bi-directional, and for most other countries where renewable generation is significant, the tests for causality are ambiguous.

There are two important exceptions from those results: For Albania, an expansion of installed renewable capacity has a negative impact on growth, and for Turkey, the coefficient for renewable capacity becomes significantly negative if one includes R\&D expenditures as additional explaining variable. The negative effect here might be covered, as renewable electricity might serve as proxy for the adaption of innovations in a country. For both countries, this negative effect that showed up in my results should be explored more in-depth. If it is confirmed, this should have consequences regarding the policy towards renewables in both countries.