

Referee Report of the paper with the title:

“Energy Consumption and the Size of the Informal Economy”

written by

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In this paper the authors empirically investigate the relationship between energy consumption and the size of the informal economy. They rely on panel data regression models, their results seem to show that the aggregate level, energy intensity is inversely related to the size of informal sector, providing actual empirical evidence on the presence of high labor and low capital intensity in the informal economy. Furthermore, the authors claim that they find some support towards the presence of non-linearity and asymmetry in this relationship.

This is a purely empirical but interesting and stimulating piece of research which, I think, for the first time investigates the relationship between energy consumption and the size of the informal economy.

However as the paper stands now, I think, it has to undergo a major revision. I have the following points of criticism:

1. Missing theoretical considerations

What is somewhat amazing, that in this paper not even one page is devoted to some theoretical considerations between energy consumption and size and development of a shadow economy, either in a highly developed OECD or in

developing countries, or in countries in between. I really think, the authors should add a small chapter “Theoretical Considerations” in which they model the energy consumption and the possible relation to the size and development of the shadow economy. Then the authors should derive their main hypotheses e.g. that this relationship is negative, meaning the higher the shadow economy, the lower is energy consumption, *ceteris paribus*. They should also modify this hypothesis with respect to non-linearity and asymmetry, if necessary. In this chapter the authors should clearly develop their “care” hypotheses and they should justify theoretically this. They should end with a test equation and clearly derive the signs of the most important variable. From a theoretical standpoint it is really not enough to write on page 2 ...Since energy consumption is highly induced by capital intensity in production considering the lower capital intensity of the informal sector, *ceteris paribus*, we expect that countries with a larger informal sector have lower levels of energy consumption...”.

2. Are the *ceteris paribus* conditions fulfilled?

What is also quite amazing to me, that in according to the authors, their model of energy intensity is “only” a function of the shadow economy and of past energy intensity and a time trend. Is this really so? Are there no other important variables which drive energy intensity, like the development of the official economy, technical progress? Can one really model energy intensity as a function of the shadow economy and the time trend? I really believe not. The authors should at least clearly show that these variables are the driving forces and that there are no other important statistical influences beside the shadow economy and the time trend. This is not shown and I am pretty convinced there are other important factors which might also significantly change the shadow

economy results because then we have a possible regression bias due to omitted variables. Hence, here a really careful test is needed to show that one can do this regression results without adding other variables or that the ceteris paribus conditions are fulfilled only having the shadow economy past energy intensity and a time trend. For example what happens if the authors include GDP per capita in their regression models, and include variables like technical productivity? They should really test this.

3. The Shadow Economy Data of the authors

The authors have due to their new method quite a panel data set of the shadow economy for 159 countries over the years 1980-2012. This is fine. However they say little about the “production” of these shadow economy data. In an appendix, they should at least show for 2-4 countries, how precisely they get their shadow economy results. Does these data still have a strongly negative trend, meaning that the values of the shadow economy are quite high in the 80s and then continuously decline, at least the interested reader should see what the development of the shadow economy is.

I think, the economic exercises are fine with my big criticism, the ceteris paribus conditions are not fulfilled and the regression might have an omitted variable bias. As I said in my point three the authors should really check this. I do not believe that these factors are the only ones which influence in energy intensity.

4. Conclusions

In the light of a possible omitted variable bias the authors should then revise their conclusions.

5. Overall evaluation

Let me clearly say, this is an interesting and stimulating piece of research. However, as the paper stands now, it should be revised and at least the authors should tackle these four critical points.