Latitudinal Effect on Energy Savings from Daylight Saving Time

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Overview

The use of daylight saving time (DST) is typically justified by reference to energy savings. There are a large number of recent studies of actual electric energy savings resulting from the use of DST. These studies have yielded not only a large range in the magnitude of the energy savings, but also shown that in some cases DST seems to result in an increase in energy consumption. A recent meta-analysis of 44 published studies shows on average a modest energy savings from DST at 0.34% during the DST period (Havranek, Herman, Irsova, 2016). They find that the latitude of the country is one of the most important factors explaining the heterogeneity of the results in the literature.

Past studies of electric energy savings from DST are typically limited to one country and without regard to potential latitudinal effects. Weinhardt (2013) looks at latitudinal effects of DST in the US, and find differing effects in the west compared to the east. This study is using time-aggregated data and is therefore not directly comparable with most other studies that are using data with higher time resolution.

This paper looks at the potential systematic variation in electric energy savings resulting from DST in a number of geographic areas varying in latitude ranging from Northern to Southern Europe. Using a consistent set of data, models and estimation techniques we want to test if latitude has a systematic impact on the potential electricity savings from a DST policy.

Methods

We use a database of hourly energy consumption in a number of geographical areas ranging from Northern Sweden and Norway to Southern Italy and Portugal. The data for hourly electricity consumption comes from the Nord Pool day-ahead market (http://npspot.com/) for the Nordic and Baltic countries, Terna Rete Italia (http://www.terna.it/) for the Italian market, and the ENTSOE Transparency Platform (https://transparency.entsoe.eu/). In all there are 48 countries/bidding zones with hourly consumption data covering the whole of, or parts of, the period 2005 through 2016. Temperature data for representative (central) airports comes from the Weather Underground web-site (https://www.wunderground.com).

The European countries have had in place a common DST policy for many years so it is not possible to exploit any cross country variations. We use two different methods for estimating the potential energy savings. One technique is the equivalent day normalization approach employed by Mirza and Bergland (2011). This approach relies on the fact that midday and midnight hours remain unaffected by changes in clock timings and can be used as control hours. The approach yields an estimate for the average change in energy consumption in the DST period. The other approach is a regression discontinuity design applied to the transitions into and out of the DST period.. This approach yields an estimate for marginal change in energy consumption following the switch into DST in the spring and out of DST in the fall.

Results

An analysis based on the equivalent day normalization of the 48 different geographical locations support a hypothesis of a latitudinal impact on the energy savings from DST. The energy savings are larger in the southern most locations compared to the northern most locations. There is, however, a large variation within the more southern latitude.

The marginal effects from the RDD analysis show some of the same geographical patterns. The savings effect in the spring is greater than the effect in the fall. The fall effect is for many locations rather an increase in energy consumption, thus supporting the claim that DST should be in effect all year.

Conclusions

Past studies of the potential electric energy savings effect of a DST policy show a range of different effects ranging from clear positive effects to weak negative effects. We find very clearly that DST has an energy saving effects across of all Europe. The magnitude varies from less than 0.5 percent to more than 2.5 percent. Furthermore we find that latitude plays a an important role in explaining differences in energy savings from DST with a larger effect of DST in southern locations compared to northern locations.

Our study contributes to the literature by being one of the first multiple country studies of the energy savings effects of DST. We are using the same econometric specification and estimation method for a consistent data set of electricity load covering 35 countries in Europe. Thus our results provide a comprehensive set of consistent and comparable estimates of the DST effect.

References

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