Modeling the emissions-income relationship using long-run growth rates

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ONLINE APPENDIX

DATA SOURCES

GDP, Population, Area, Trade Openness

Apart from country area, which is from the *World Development Indicators*, these are sourced from the Penn World Table (PWT) version 8.0 (Feenstra *et al*. (2015; www.ggdc.net/pwt). PWT 8.0 provides GDP data adjusted for purchasing power parity for 167 countries for 1950–2011, though not all countries have a complete time series. For the period we are interested in, there are complete series for 143 countries. Following the advice of Feenstra *et al*., we compute the growth rates of GDP using the series RGDPNA, which uses the growth rate of real GDP from each country's national accounts to extrapolate GDP from 2005 to other years. RGDPNA is set equal to the variables CGDPO and RGDPO in 2005. The latter variables are output-side measures of real GDP that take into account the effect of changes in the terms of trade in order to better represent the real production capacity of the economy. Also following the recommendation of Feenstra *et al*., we use the variable CGDPO to measure the level of GDP in constant 2005 millions of purchasing power parity adjusted dollars. This variable measures output-side GDP across countries using the reference price vector for each year and then adjusting for US inflation over time.

Trade openness is calculated as the average ratio of the sum of merchandise exports and imports to GDP over the period.

Emissions

We use data on carbon dioxide emissions from the Carbon Dioxide Information Analysis Center (CDIAC) (Boden *et al*., 2013). CDIAC produces annual data at global and national scales for 249 countries for varying periods during 1751–2010. These are for emissions from the combustion of fossil fuels, gas flaring, and cement production and can be downloaded from: http://cdiac.ornl.gov/trends/emis/overview_2010.html. Emissions are in thousand metric tons of carbon, which we convert to carbon dioxide by multiplying by 44/12. When

we match CDIAC data to PWT data we obtain a balanced dataset for 136 countries covering 1971–2010.

Anthropogenic sulfur dioxide emission data are from Smith *et al*. (2011), who provide annual estimates for 142 countries for 1850–2005. When combined with PWT data, we obtain a balanced dataset for 103 countries for 1971–2005. Data are in thousands of metric tonnes of SO_2 and can be downloaded from: http://sedac.ciesin.columbia.edu/data/set/haso2 -anthro-sulfur-dioxide-emissions-1850-2005-v2-86.

Because of the coverage of the Penn World Table, some countries are excluded from our datasets. These include Russia and the other successor states of the erstwhile Soviet-Union, and the successor states of Yugoslavia. Other countries with large populations that are excluded are Bangladesh and Pakistan.

Centrally Planned Economies

We identify centrally planned economies using a dummy variable equal to one for those countries on the list of transition economies in table 3.1 in IMF (2000). In our sample, these are: Bulgaria, Hungary, Poland, Romania, Albania, Cambodia, China, Laos, and Vietnam.

Legal Origin

We treat English legal origin as the default and assign zero-one dummies for German, French, and Scandinavian legal origin using the classification of La Porta *et al*. (2008). The data are available at: http://scholar.harvard.edu/shleifer/publications/economic-consequences-legal-origins

Temperature

Average temperature in degrees Celsius for 1960–1990 by country and month are available from Mitchell *et al*. (2003). The data are available at:

http://www.cru.uea.ac.uk/~timm/climate/index.html

We average the temperature of the three summer months – June to August in the Northern Hemisphere and December to February in the Southern Hemisphere – to obtain a summer temperature variable. We average the temperature of the three winter months to obtain a winter temperature variable. This should give a better idea of the demand for cooling and heating than simply using the temperature of the hottest and coldest months.

Energy Endowments

We multiply Norman's (2009) ratio of the value of fossil fuel stocks to GDP in 1971 by GDP per capita at market exchange rates in 1971 (World Bank) to derive the value of per capita fossil fuel endowments in 1971 US dollars. As there are some zero values, we add one dollar to this value before taking logs. As the median value for countries with non-zero resources is $359 this does not change the data for countries with significant resources by very much.

Gasoline Prices

Data on the average gasoline pump price are provided by the *World Development Indicators* for various years between 1991 and 2010 in nominal US dollars. We convert these into 2005 US dollars per liter using the US GDP deflator and then take an average of the price for each country over the years available for that country.

References

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