Comment: "Microdata and the Valuation of Natural Capital," by Jonathan Colmer and John Voorheis

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Can we improve estimates of the value of natural capital by using high-resolution data on the population and the distribution of environmental amenities? Under what circumstances does the spatial unit of analysis affect our estimates of the value of natural capital? In their chapter, Colmer and Voorheis (2024) use high-resolution data from the Census, paired with remotely-sensed estimates of tree canopy cover, to illustrate the potential importance of individual-level data in such valuation applications.

In this comment, I discuss how high spatial resolution, individual-level data could be important in natural capital applications. There are two interrelated factors that I will focus on: the degree of variation of the environmental good over space, and the extent to which demand for the environmental good varies with population characteristics.

Heterogeneity Over Space

Some amenities vary significantly even within a small geographic area. Air pollution and urban tree canopy, two examples from Colmer and Voorheis (2024), both vary significantly between cities but also within a given urban area. The degree of variation within a Core Based Statistical Area (CBSA) will depend on the application, but for urban canopy cover, there can be significant heterogeneity even within a census tract or block group.

Other amenities may vary more *between* locations. The amount of land in forestry or agriculture, for example, will vary significantly between counties but less within a city block. Similarly, some environmental amenities such as lakes, coastal beaches, and urban parks may have coverage that varies within a tract or block group, but the geographic coverage is continuous and well-defined. In contrast, urban canopy cover is patchy, with significant variation even within a city block.

With air pollution, some pollutants vary significantly even within an urban block (e.g. black carbon), whereas others are better categorized as varying regionally (Apte et al, 2017).

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As other work has shown (Voorheis et al 2023), the variation of demographic characteristics is also a critical consideration when looking at exposure to environmental amenities or disamenities like pollution. In many cases, income may vary more w*ithin* a census tract than *between* census tracts.

Why does this matter? As Colmer and Voorheis illustrate, the assignment of exposure or access to an environmental amenity could be highly local. One person may live in a location with a high level of urban canopy while their neighbor may have little. And the degree of coverage affects a variety of outcomes, from cooling effects to buffering against exposure to air pollution.

In situations where we are interested in quantifying *who* has access to an environmental amenity or *who* is exposed to a disamenity such as pollution, it is critical that we understand how population and environmental characteristics vary over space. The EIF data, combined with high resolution environmental data, allows researchers and policymakers to better understand who has access/exposure to environmental goods and services.

Heterogeneity and Valuation

Individuals value environmental goods and services for a variety of reasons (use, non-use and option values), and economists have developed a set of tools based on revealed and stated preferences to estimate values of such non-market goods. Although Colmer and Voorheis do not estimate the value of canopy cover, they illustrate the importance of understanding how the distribution of natural capital could affect its value.

There has long been a debate about the scale of analysis in hedonic applications. For example, Grainger 2012 compares tract-level and county-level estimates of the impact of improvement in air quality. In these applications, the spatial scale of estimation matters when pricing environmental goods or bads. In Grainger (2012), he argues that pollution reductions are targeted *within* nonattainment counties, so impacts near monitors in violation will experience larger pollution reductions (following Auffhammer, Bento and Lowe (2009)).

In the case of Superfund site cleanups, Greenstone and Gallagher (2008) find no significant impact on housing prices at the tract level. Gamper-Rabindran and Timmins (2013) revisit this analysis using finer scale data and find that effects of cleanups are positive but localized.

With urban canopy cover in Colmer and Voorheis, however, there is still significant *within-block* variation in canopy cover. Colmer and Voorheis illustrate that even block-group-level analysis could lead to significant aggregation bias, which would likely bias any hedonic estimates of the value of canopy cover.

Demand for environmental goods and services is generally a function of income, so there may not be "one price" to apply in natural accounting exercises. As such, understanding the income-demand relationship (i.e. Engel Curves) would be critical if individual data on exposure or access were used to develop estimates of the value of natural capital.

Implications

The EIF data illustrated by Colmer and Voorheis, and discussed at length in Voorheis et al (2023), will undoubtedly prove to be useful in a variety of important applications. I'll conclude with a few observations regarding the practical implications of the data described here.

Characterizing the Distribution of Exposure

As illustrated in their canopy example, assigning exposure at the individual and aggregating to the population leads to very different conclusions than assigning exposure based on percentiles of the distribution of median income at the block or tract level. If researchers or policymakers are concerned with the distribution of exposure to environmental amenities, this has important implications.

Place-Based Policies vs Targeted Policies

Some environmental amenities vary more at the local level than others. As Colmer and Voorheis show, the *within-block* variation in canopy cover is significant, and that has implications when assigning exposure to individuals and aggregating. Other environmental amenities do not exhibit such dramatic heterogeneity at a fine spatial scale. Regional air pollution, for example, or access to conserved land, vary more between blocks.

It is also worth noting that the degree of targeting in policy also varies, depending on the specific application. For pollution from a point source such as a refinery, there may be directed policies to reduce exposure at the neighborhood level. Other policies may have impacts that cause changes in natural capital at higher levels of geography. In both cases, there may be aggregation bias when illustrating the distribution of exposure by income. But many policies are place-based, and environmental justice communities are defined spatially, not as collections of individuals dispersed over large areas, so in some cases the "right" metric may indeed be characterized by median income, the proportion of households under the poverty line, or the proportion of the population from underrepresented groups.

Natural Capital Accounts and Microdata

In summary, as Colmer and Voorheis point out, adding Engel Curves to data on individual exposure to an environmental amenity could help when aggregating to the value of an amenity over space. In many empirical applications, willingness to pay is a function of income but also varies by other demographic characteristics (age, race, ethnicity, education). In these types of applications, should the value of the natural capital take into account all observable characteristics of individuals when aggregating across population and over space? There remain questions about how microdata can be utilized and when they *should* be utilized in developing natural capital accounts, and I hope that future research will continue pushing this forward.

References

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