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Lessons From Ten Years of Household Recycling in the United States

by W. Kip Viscusi, Joel Huber, and Jason Bell

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Recycling is perhaps the most prevalent pro-environmental activity at the household level. Households undertake recycling on their own initiative, though recycling efforts may be influenced by supportive nudges and, in some cases, laws that mandate recycling behavior. However, unlike pro-environmental efforts such as decreasing household energy usage, the success of the household's intention to recycle also hinges on governmental support. People cannot engage in recycling behavior on their own, as there must be some mechanism for collecting the recycled materials and converting them into useable commodities. The availability and nature of the recycling opportunities affect the household's ability to recycle and the difficulty of doing so. Governmental entities, and in some cases private waste collection firms, provide for these recycling amenities.

Although most states have some sort of statewide recycling laws, new recycling initiatives have not been prominent. Has recycling behavior stabilized or perhaps dropped in the current era in which there have been fewer new state recycling initiatives? To explore recycling trends and the factors related to these trends, this Comment uses a comprehensive national database covering U.S. recycling over a 10-year period beginning in 2005. The data indicate increases in recycling behavior over 10 years for all materials and in all four U.S. Census regions.

Household recycling levels differ depending on the kinds of materials: paper, plastic, glass, and cans. These differences are consistent with differential effort required and the costs associated with municipal recycling programs. Additionally, the data indicate that household recycling penetration differs strongly by region. We explore three factors associated with these differences. First, regions with greater population density and greater per capita income recycle substantially more. Second, greater success comes with state laws that encourage pickup facilities that make household recycling easier and require the use of those facilities. Finally, those states whose elected governments are dominated by Democrats recycle 30% more than those dominated by Republicans.

One would not expect the period from 2005 to 2015 to be one in which recycling efforts would flourish. There were no major changes in state recycling statutes during that time, and there were substantial economic headwinds against recycling. The December 2008-June 2009 recession diminished states' financial resources and the ability to provide financial support for household recycling. Further, the drop in the prices of recycled materials, which we document below, decreased the economic payoff that municipalities could rely upon to support the effort.

Prominent sources of the decline in the value of recycled materials include the 2008 recession as well as fracking, which reduced the value of recycled plastics, and recent actions by China, which has begun decreasing its imports of recycled materials. A 2009 *New York Times* article noted: "The United States exported \$22 billion worth of recycled materials to 152 countries in 2007. Now [the Institute of Scrap Recycling Industries] estimates the value of American recyclables has decreased by 50 to 70 percent. . . . Chinese importers have been demanding to renegotiate contracts drastically downward."¹ Despite these problems, we show that the overall recycling trends remain positive.

The data we use for our analysis are based on surveys that Knowledge Networks, now the GfK KnowledgePanel, administered to its national panel for a 10-year period from 2005 to 2014.² The survey respondents were recruited based on a probability sampling approach, generating a sample composition that is broadly representative of the U.S. population. Over the 10-year period of our analysis, we have 407,007 observations from surveys taken by 171,340 households, to the best of our knowledge, the largest longitudinal national data set on individual household recycling behavior.

1. Dan Levin, *China's Big Recycling Market Is Sagging*, N.Y. TIMES, Mar. 11, 2009.

2. Household data derive from the authors' analysis of background surveys administered regularly to the GfK KnowledgePanel. See GfK, *KnowledgePanel (United States)*, <http://www.gfk.com/products-a-z/us/knowledgepanel-united-states/> (last visited Mar. 1, 2018). The panel was formerly known as Knowledge Networks.

Respondents provided information on whether they recycled any cans, plastic, paper, and glass in the past year. After examining the changes across these four materials, we will focus on an aggregate measure of whether the household recycled all four of the most commonly recycled materials. That measure is particularly revealing, since our earlier work indicates that individual households beginning to do one kind of recycling soon include other materials.³

One might be cautious about drawing conclusions from recycling data that are both self-reported and do not characterize how often the household recycles. However, we have found that the quantity of materials being recycled is strongly correlated with the household's self-reported recycling measures. In particular, for the state of Wisconsin, we had information on tonnage of recyclable materials by county, and we found that to have a strong positive correlation with reported household recycling rates in surveyed households.⁴ Thus, our variable serves as a meaningful index of the intensity of recycling behavior, and will be particularly instructive in providing insight into trends in this behavior over time.

I. National Recycling Rates

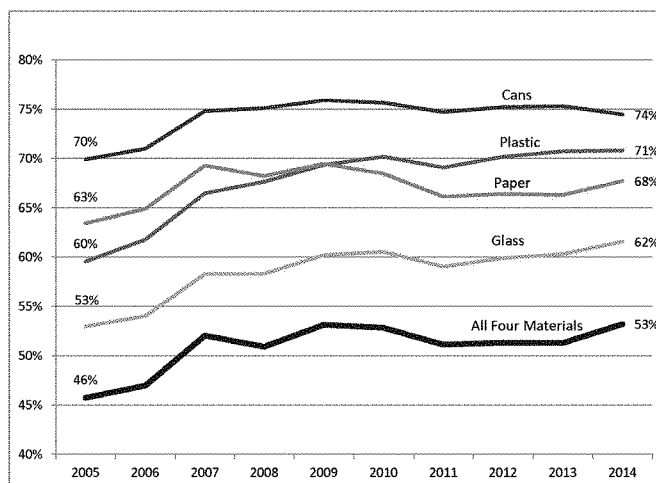
Consider first the recycling rates across four commonly recycled materials. The extent to which different materials are recycled will depend on how frequently the household uses those materials, the amount of effort required by the household in undertaking such recycling, the financial rewards for recycling in terms of deposits on bottles and cans, and the degree to which local recycling policies foster recycling of the particular material.

Figure 1 provides evidence on the reported recycling rates of four materials for the 2005 to 2014 period. Throughout that entire period, the highest recycling rates are for cans, which had a recycling rate of 74% in 2014, and the lowest rates are for glass, which had a recycling rate of 62% in 2014. The largest increases in recycling rates over the decade were the 11 percentage point increase for plastic and the nine-point increase for glass.

Recycling rates for cans and paper increased to a lesser extent. Paper formerly was the second most recycled material, but the decline in print newspaper sales and the increased use of plastic bottles, both for bottled water and other beverages, has moved recycling of plastic into the second-ranked position starting in 2009. The high recent recycling rates for plastic are also attributable to the fact that these products tend to be lighter and easier to recycle, and also easier for consumers to transport, which accounts for their growing popularity as food and drink containers.

Declining prices for recycling outputs affected the four materials differently. Paper prices suffered enormous losses, with a drop of more than 90% from the peak, recovering

Figure 1. National Recycling Rates for Four Materials and for All Four Combined



to a steady price level of only 40% of the pre-crisis high. Cans experienced a smaller drop, 50%, but eventually those prices recovered. Glass prices, depending on color, dropped around 30% and also eventually recovered. Prices for recycled plastics fell 70% to 90% from their pre-crash highs, though the price of plastics slowly recovered over the next several years.⁵

Despite these difficulties, recycling has seen a seven-point increase in the households that are recycling all four of these materials. This increase suggests that more people are becoming committed recyclers in general, not simply for any particular material. Another indicator of the apparent recycling commitment is that the trend in recycling propensities only exhibited a minor dip for some materials in the wake of the recession throughout 2008.

II. Recycling Rates by Region

While one might expect based on the trends by materials that recycling rates will hit a ceiling, perhaps at around 75% paralleling the trajectory for cans, review of recycling rates by region provides evidence that there remain opportunities for increasing recycling overall. Regions recycle at different rates due to varying geographic conditions, population density, economic capabilities, and physical barriers like mountains. As we will show, recycling rates differ depending on the intensity and effectiveness of recycling laws, as these logically affect the availability of recycling amenities provided to households such as curbside pickup, single-stream recycling, and convenient recycling locations.

As shown on the map in Figure 2 generated by our data, the Northeast leads in the frequency of recycling, followed by the West, the Midwest, and finally the South. In terms of growth, the two most consistently prominent regions—Northeast and West—have been relatively stable over the

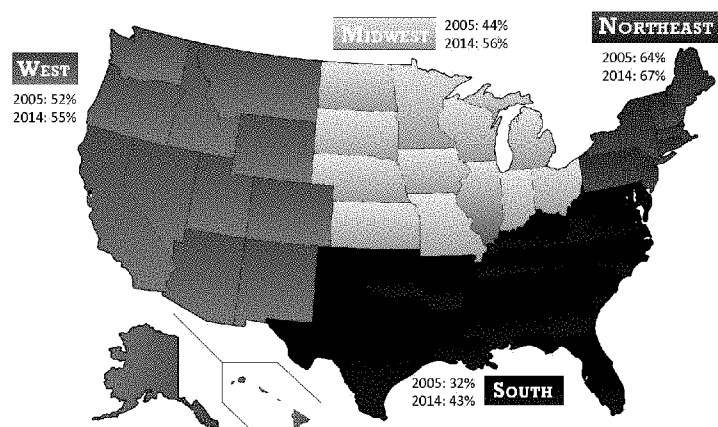
3. See W. Kip Viscusi et al., *Discontinuous Behavioral Responses to Recycling Laws and Plastic Water Bottle Deposits*, 15 AM. L. ECON. REV. 110 (2013).

4. See Jason Bell et al., *Fostering Recycling Participation in Wisconsin Households Through Single-Stream Programs*, 93 LAND ECON. 481 (2017).

5. Post-consumer recovered materials prices were obtained from historical data at RecyclingMarkets.net. Further, mixed-color glass does not have a positive market value unless considered relative to the cost of landfill disposal.

decade, with recycling rates differing by less than three percentage points from the beginning to the end of the decade. By contrast, the Midwest and South have shown substantial growth.

Figure 2. Percent Recycling All Four Materials by Region



The strong growth in the Midwest and South suggests that these rates have not hit a plateau. One factor that contributes to regional differences is that lower recycling rates occur in regions having large areas with low population, such as sections of the South and rural areas in the West and Midwest. Across the country, counties with U.S. Census-reported densities of less than 100 residents per square mile generate a 26% rate of recycling all four materials. Counties in the range of 100-250 residents per square mile recycle at a 45% rate; those between 250 and 500 residents per square mile recycle at 52%. Counties with more than 500 residents per square mile recycle at a 59% rate.

III. The Importance of Legal Regimes

An important determinant of why recycling rates differ by region is the recycling laws that are in place in different states. Almost all of these laws were enacted before 2005

and have changed little in the following years. Table 1 gives the characteristics of these laws and the state identities.

The most stringent recycling laws were enacted in the six states (plus the District of Columbia) that mandate households to recycle. An example of the text of this type of law, from Connecticut, states, "The Commissioner of Environmental Protection shall adopt regulations . . . designating items that are required to be recycled. . . . Each person who generates solid waste from residential property shall . . . separate from other solid waste the items designated for recycling pursuant to subsection (a) of this section."⁶

The next most-ambitious recycling laws require that municipalities provide the opportunity for residents to recycle through appropriate facilities, such as drop-off recycling stations or curbside pickup. Arizona has such a law, which states, "A city or town shall provide its residents with an opportunity to engage in recycling and waste reduction."⁷

Weaker laws come from 15 states that expect municipalities to have recycling planning, but do not require specific recycling amenities. Alabama's planning law states, "The director of the Alabama Department of Environmental Management, with the advice and consultation of the Solid Waste Management Advisory Committee, is directed to prepare a State Solid Waste Management Plan."⁸

The remaining 21 states at the weakest levels either have no recycling law, or else simply specify a general recycling goal without imposing mandates or providing recycling opportunities or plans. Montana's goal law states, "It is the goal of the state to reduce, through source reduction, reuse, recycling, and composting, the amount of solid waste that is generated by households, businesses, and governments and that is either disposed of in landfills or burned in an incinerator."⁹

Figure 3 shows that the effective recycling rates for these different legal regimes accords with their relative stringency. In 2014, the average recycling rates were 67% in mandatory states, 60% in opportunity states, 50% in recy-

Table 1. States With Each Type of Recycling Law

Type of state law	States
Mandatory recycling	CT, DC, NJ, NY, PA, WV, WI
Opportunity to recycle	AZ, AR, FL, MN, NV, OR, SC, WA
Recycling plan	AL, CA, HI, IL, IA, ME, MD, MI, NE, NM, NC, OH, TN, TX, VA
Recycling goal	LA, MS, MT, NH, RI, SD
No recycling law	AK, CO, DE, GA, ID, IN, KS, KY, MA, MO, ND, OK, UT, VT, WY

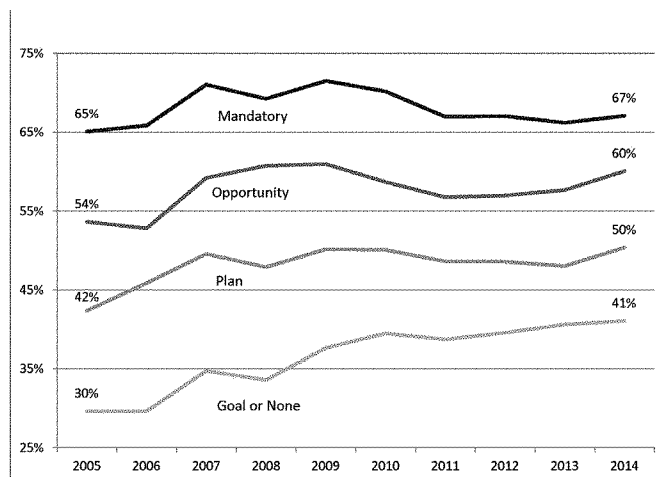
6. CONN. GEN. STAT. §22a-241b (2012).

7. ARIZ. REV. STAT. ANN. §9-500.07 (2016).

8. ALA. CODE §22-27-45 (2006).

9. MONT. CODE ANN. §75-10-803 (2015).

Figure 3. Recycling Rates for All Four Materials by Legal Regime



clinging plan states, and 41% in the states with either goals or no laws. Irrespective of the legal regime, recycling rates rose over the decade, with the greatest gains from states with the least aggressive laws. The recession caused a temporary reduction in recycling under all legal regimes except those that required households be provided an opportunity to recycle.

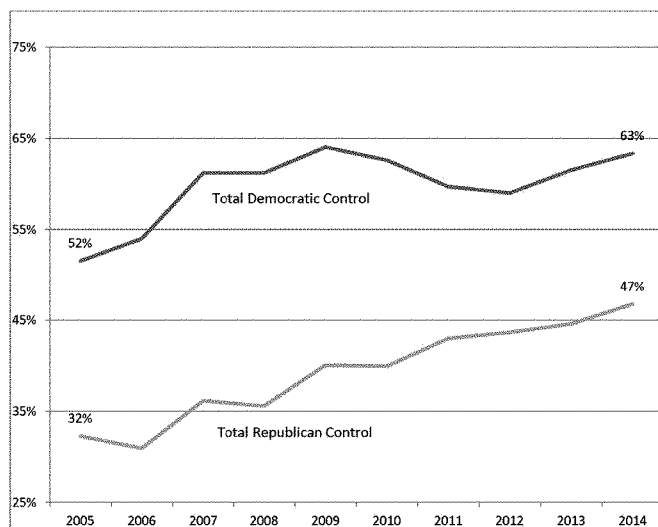
IV. Political Parties

The controlling political party in the state is associated with many variables likely to affect recycling behavior—the prevalence of pro-environmental attitudes, population density, and state government spending levels. Figure 4 shows the relationship between political parties and recycling. As one might expect, both because of geography and pro-environmental attitudes, states controlled by Democrats (where both governor and legislature are Democratic) have higher recycling rates than Republican-controlled states. These results are consistent with the emphasis by Democrats on government actions to further policy goals, contrasting with Republicans who value reliance on individual responsibility.

Despite these differences in levels, the trends provide a hopeful signal of potential improvements in the Republican-controlled states. The relatively greater gains in the Republican-controlled states is consistent with the earlier result that regions with low recycling rates are capitalizing on the greatest opportunities for gains.

Region, state laws, and politics each have strong relationships with household recycling levels, but they are not completely independent. The high-recycling Northeast is predominantly Democratic and has the most stringent laws, while the lower-recycling South reverses all three

Figure 4. Recycling Rates for All Four Materials by Dominant Political Party of State



trends. If we predict recycling statistically as a function of the stringency of state laws, the four regions, and politics, we find that each has independent effects after controlling for the other variables.

V. Conclusion

This analysis of 10 years of data on household recycling reveals a number of important findings. The first is that there are substantial differences between recycling levels and growth, arising from whether the material is paper, plastic, cans, or glass. Second, even though there were no new major national or statewide changes in laws pertaining to recycling enacted between 2005 and 2014, recycling rates for all materials continued to increase over that time. Third, recycling rates differ by region, where the recycling laws and political control were key determinants of recycling rates, as were influences such as population density. Fourth, the greatest gains in recycling behavior have occurred where initial recycling rates were lowest. Thus, the increases in recycling were greater for materials with lower recycling rates, for regions with lower recycling rates, for states with weaker recycling laws, and for states with initially less-favorable political climates.

The continued progress in recycling rates is especially remarkable in that it has occurred despite the deterrent effect of both the Great Recession and the diminished value of recycled materials. Whereas one might expect that recycling of all four materials may have reached a plateau of about 60% participation nationwide, the continued improvements in recycling in the areas with weaker recycling performance highlight the potential for additional increases in recycling behavior.