Joint Center for Housing Studies
Harvard University

Green Shoots in the Remodeling Industry: Contractor Characteristics That Affect Green Product Use

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Abstract

Energy efficiency and environmental sustainability have benefited from increased media attention in recent years. Despite a proven record of improving the energy efficiency of homes, however, green remodeling has not received the attention or study that sustainable new home construction has received. This paper uses a survey of remodeling contractors to examine the role of government regulations in promoting the use of green products, as well as whether certain contractor characteristics are associated with higher levels of green product use.

Government regulations tend to favor environmentally sustainable products over other green categories. These policies appear to have a positive effect on the use of green remodeling products in general, but sometimes even strong government support is not sufficient to encourage substantial use. In general, consumers seem less likely to obtain additional products, that are not strictly substitutes for traditional products, to improve the energy efficiency and environmental sustainability of their home.

Simple regression analyses show that, contrary to the view that green project goals are simply "greenwashing" traditional remodeling projects, contractors who reported energy efficiency or environmental sustainability as a stated goal for the majority of their projects are more likely to use green products and see those products sell as well as or better than traditional products. Green certified companies use more green products than non-certified companies, but these green products do not necessarily sell better than traditional products for those companies. This may be due to the low profile of certification programs, especially when compared to those in the home building industry. As certification programs gain recognition, the benefit to holding such certification will likely increase.

Introduction

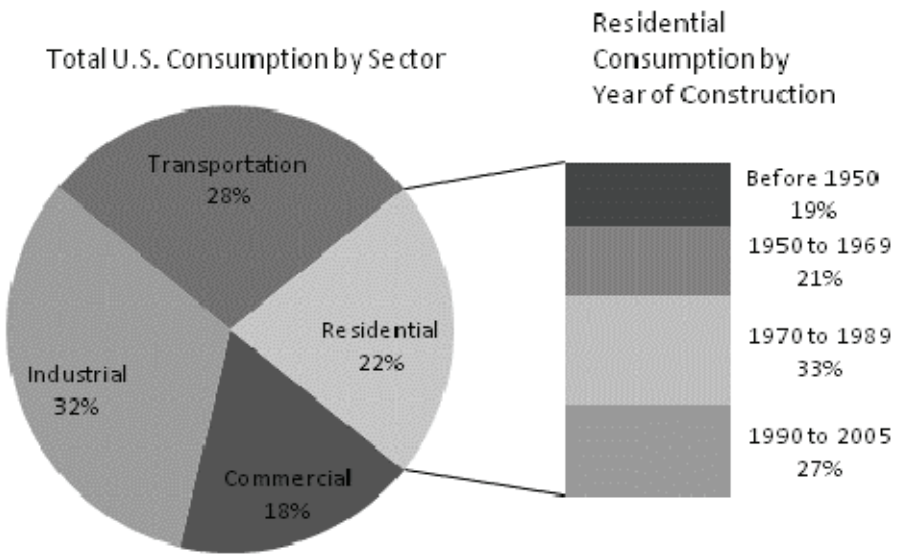
The public awareness of all things green, meaning environmentally friendly, has never been greater. In the realm of housing, there has been steady progress towards better energy efficiency for decades, not only in new construction but also in the existing housing stock through home improvements. The continued development of new technologies and the increasing consumer interest in environmentally friendly products presents a growing market for remodeling contractors. This market niche, however, has not been sufficiently analyzed. Indeed, the ambiguous definition of green, particularly in a home improvement context, combined with the scarcity of reliable remodeling data in general limits sophisticated and detailed research in this field. Consequently, the Joint Center for Housing Studies of Harvard University undertook its own survey of remodeling contractors and green remodeling products to analyze the impact of these products and their use on the remodeling industry.

The purpose of this research is to estimate the overall level of adoption for green remodeling products, including how adoption varies by characteristics of the product, as well as the importance of government regulation in supporting green remodeling. In addition, contractor characteristics are examined to explain the variation in product use among remodeling contractors and the variation in the relative sales of green remodeling products during the current industry downturn. Specifically, this paper examines the significance of certification programs, firm specialization, project initiatives, and other characteristics in increasing the use of green products and generating more business for remodeling contractors. Finally, this paper discusses the implications of these findings for the industry and public policy and makes recommendations for future research. Regression analysis of survey results finds that green specialization is more than simply "greenwashing" traditional remodeling projects and is associated with increased use of green remodeling products and stronger sales of those products compared to traditional business. Green certification and companies with larger remodeling revenue are correlated with increased green product use, and the sale of green products seems to be faring relatively better in the Midwest than in the nation overall. In addition, individual product sales are significantly affected by the degree of government support, making the role of public policy in promoting green products important.

Background

Figure 1: Housing Contributes Significantly to Overall Energy Consumption

U.S. Annual Energy Consumption in 2005 (Total=100 Quadrillion BTUs)

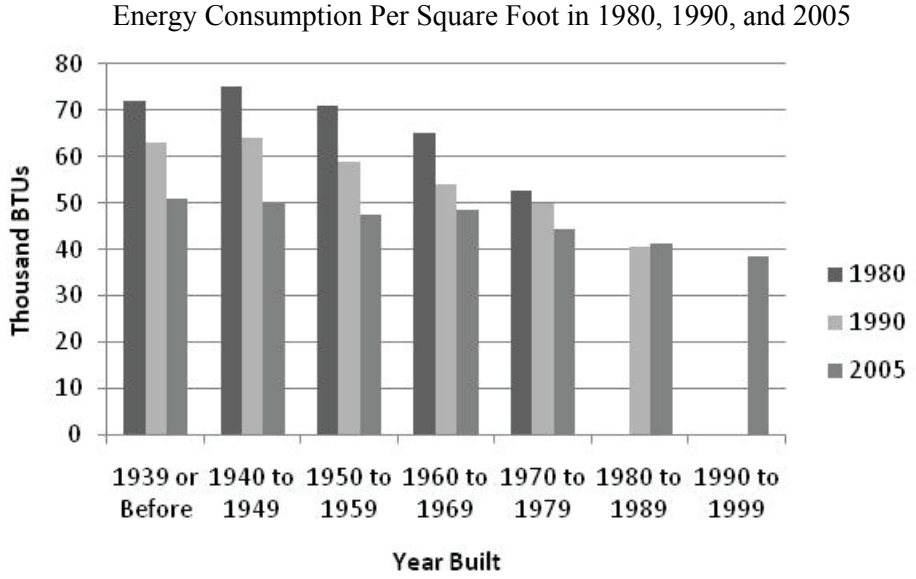


Source: Energy Information Administration, Annual Energy Review and Residential Energy Consumption Survey, 2005.

Existing residential buildings accounted for 22 percent of energy consumption in the United States in 2005 (see Figure 1). Due to improvements in construction techniques and materials, newer houses are more energy efficient than older ones. For example, units built in the 1990s use 25 percent less energy per square foot than those built before 1970. For the most part, these advances have enabled homes to be built larger without consuming additional energy but also without substantial energy savings per unit. Higher energy prices and a rethinking of housing consumption decisions in the aftermath of the real estate bust may lead to a stronger focus on smaller houses with greater energy efficiency. With an existing housing stock of over 126 million units, however, the enhancements to new homes will be inadequate to significantly change total residential energy consumption quickly. Alternatively, improvements to the existing stock can and have made substantial improvements to the overall energy efficiency of housing in the United States. An analysis of the Department of Energy's Residential Energy Consumption Survey (RECS) indicates that housing units built in the 1950s consumed 33 percent less energy per square foot in 2005 than they did in 1980 (see Figure 2). While some of the improvement is no doubt due to the demolition of less efficient units and greater energy-conserving behavior such as turning off lights and adjusting thermostats, a large share can be attributed to greater efficiencies through home improvements. The impressive results of energy

efficient remodeling combined with an increased awareness of global warming, the reliance on foreign oil, and the opportunity for technological advancement makes understanding green remodeling important.

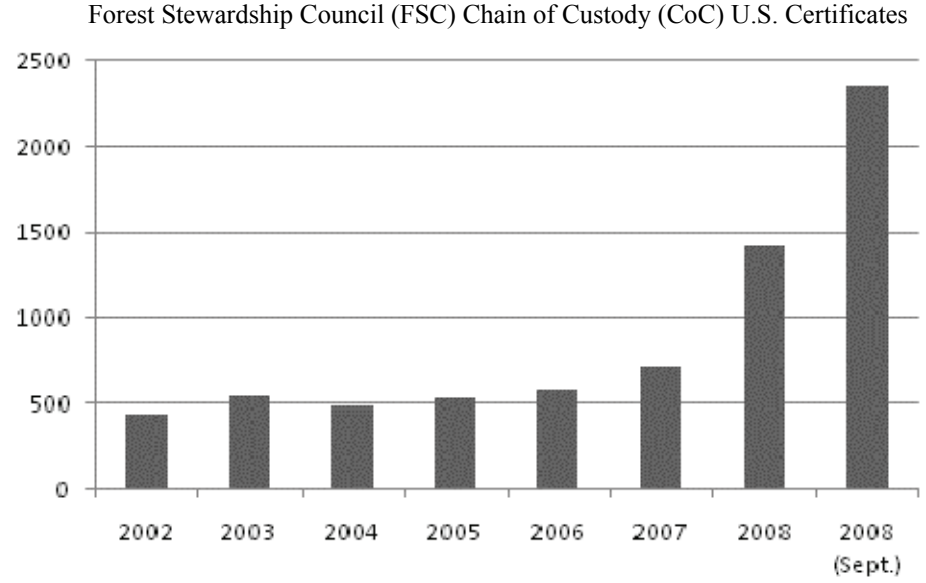
Figure 2: The Existing Housing Stock is Made More Energy Efficient Through Remodeling



Note: Total End-Use Energy.
Source: JCHS tabulations of the Residential Energy Consumption Survey

In addition to energy efficiency, consumer interest in other environmentally friendly matters has grown rapidly in the last few years. Organic foods, for example, are increasing in both sales and availability. In construction, low-flow toilets are nearly universal due to government regulations, and paints and adhesives low in volatile organic compounds (VOCs) are gaining interest. The Chain of Custody certificates issued by the Forest Stewardship Council (FSC), which can be used by companies to demonstrate their commitment to "environmentally and socially responsible forest management," more than tripled between January 2007 and September 2008 (see Figure 3). Consumers often associate such products with better quality, but they are also motivated by broader environmental concerns. How these other aspects of green remodeling will perform in comparison to relatively more straightforward energy efficient projects is not fully understood. For example, how will environmentally friendly products fare in the economic downturn compared to more traditional and less expensive products or other green products that promise clear operational savings?

Figure 3: In Homes, Green Means More Than Energy Efficiency



Source: Forest Stewardship Council

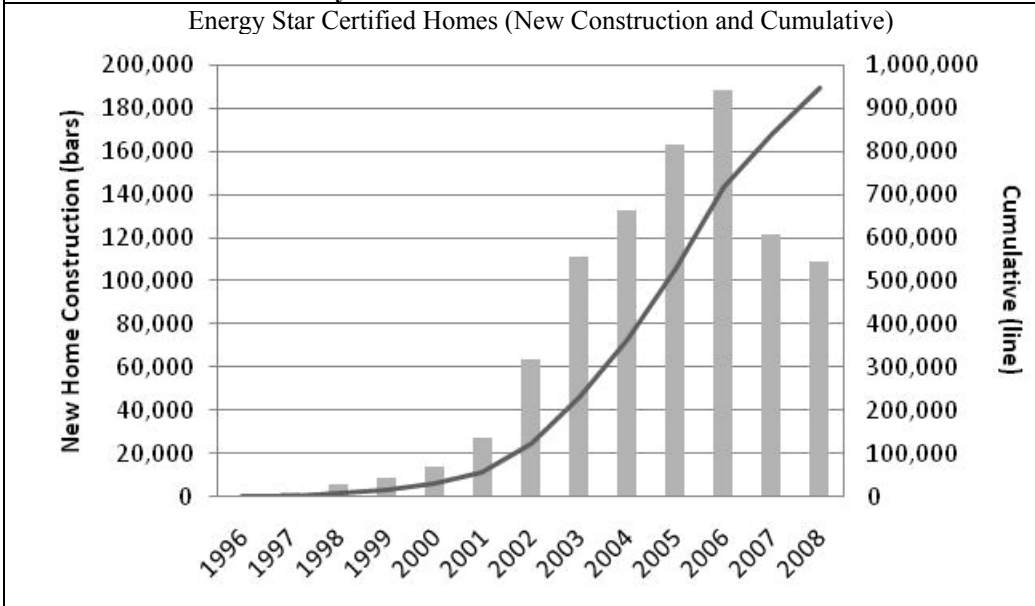
Third-party green certification in the home building industry has grown in recent years. For example, the Energy Star label has expanded from individual products to include entire houses. Created in 1992 by the U.S. Environmental Protection Agency to promote energy efficient computers, the number of product certifications has steadily grown, as has the market share of products with the Energy Star label. Approximately 940,000 homes in the United States carry the Energy Star label, including 100,000 new homes built in 2008 (see Figure 4).[1] Similar growth can be expected in the home improvement industry once certain practices are accepted as industry standards.

Green technologies, especially nontraditional products, are aided by the development of certification programs and industry standards that legitimize the claims made about the benefits of green remodeling. Developing standards leads to more informed consumers who can make rational choices about the value of improved energy efficiency without fear of "greenwashing" (falsely promoting a product as environmentally friendly).The multitude of green standards and guidelines that currently exist in the remodeling industry, however, can be confusing. The U.S. Green Building Council, which is responsible for the Leadership in Energy and Environmental Design (LEED) certification, created ReGreen guidelines for remodeling instead of a

[1] "Energy Star Overview of 2008 Achievements" http://www.energystar.gov/ia/partners/publications/pubdocs/2008%204%20pager%203-12-09.pdf

certification process. The National Association of Home Builders (NAHB) is developing a National Green Building Standard that will cover remodeling projects, and it has already granted 2,725 builders and remodelers status as Certified Green Professionals (CGP). There are also state and local programs such as Minnesota's GreenStar certification. The difficulty with developing green remodeling standards comes from the fact that remodeling projects typically involve more than individual products but less than the entire house. How all of the products are installed is vital, but even the best-installed energy efficient products may not offset other deficiencies in the home. Consequently, green certification in the remodeling industry is still in its infancy and lags significantly behind that of new home construction. A 2009 survey of remodeling contractors by *Remodeling* magazine found that nearly 70 percent of respondents indicated it would be a benefit to both remodelers and homeowners to have a national green remodeling standard. That survey also found 76 percent of respondents had never received green certifications for individual remodeling projects and 81 percent said their companies were not green certified. Furthermore, two-thirds said green certifications, or lack thereof, had not affected the volume of their bids one way or another. Of the certification programs in existence, EnergyStar and NAHB were most preferred, and respondents favored having the project certified over individual remodeler certification.

Figure 4: There Has Been Substantial Growth of Third-Party Green Certification in the Home Construction Industry



Source: Energy Star

Previous Research

Previous research conducted by the Joint Center for Housing Studies found that the cost of home energy has only a limited impact on energy efficient retrofits, and where energy costs do influence investments, it takes several years for the these upgrades to occur. The research also speculated, however, that the relationship may not be linear, and if energy prices reach and sustain a sufficiently high level, there may be an increased investment in energy efficiency (Russell).

Other studies suggest that when homeowners undertake energy efficient home improvements, much of the cost of those projects is recouped through increases in the value of the house. The research estimates that for every $1 decrease in annual home energy expenditures, house values increase between $11.63 and $20.73 (Nevin and Watson). Looking specifically at window replacements, one study suggests that high-performance windows add sufficient value to a house to fully recover the cost of replacing wood-frame single-pane windows and may exceed the cost of replacing metal-frame windows (Nevin, Bender and Gazan). Another study found that 46 million existing single-family homes in the United States had inadequate insulation, and upgrading these houses to meet the International Energy Conservation Code (IECC) would save $5.9 billion per year in reduced energy consumption, effectively paying back the initial cost of the retrofit in about six years (Levy, Nishioka and Spengler). Similarly, commercial buildings certified as energy efficient, either through EnergyStar or LEED standards, were found to have effective rents six percent higher than comparable office buildings (Eichholz, Kok, and Quigley).

There are many aspects of green remodeling that have not been researched because they either represent a small share of the overall market or there is a lack of quality data. In particular, there is little research analyzing the use of individual products to find those most commonly installed or those that receive the most support from public policy. Much of the media attention focuses on major products such as solar energy without documenting the share of green construction that these products represent. In addition, there is minimal documentation of the role the contractor plays in promoting the use of green products. Contractors often frame the choices they present their customers and therefore have an effect on final decisions. Finally, the growth of green remodeling until now has coincided with a strong expansion of the U.S. economy, but how this market, often seen as discretionary and more expensive, will fare during an industry recession is unknown. These topics are covered in the following sections.

Research

The remodeling industry suffers from lack of high quality data in general, and this is especially true about a niche market such as green remodeling. In order to more fully understand this market segment, the Joint Center for Housing Studies of Harvard University undertook its own survey of remodeling contractors with the hopes of analyzing three questions. First, what is the current level of adoption of green remodeling products and how much variation is there in adoption across different product categories? Specifically, this paper focuses on adoption levels by the type of product and the level of support through public policies. Second, how do contractor characteristics affect the use of green products? Finally, how well is green remodeling faring relative to other products during the current economic downturn and how is that affected by contractor characteristics? Data limitations prevent sophisticated analyses of these questions, but the research seeks to isolate statistically significant relationships and speculate on their larger meaning.

Methodology

The data for this paper comes from a survey of remodeling contractors conducted by the Joint Center for Housing Studies of Harvard University. The survey was administered by Specpan, a Farnsworth Group company that serves the construction and home improvement industry, using a targeted and verified online panel of construction professionals. The survey has three parts: a product-specific survey, questions on green remodeling in general, and general questions on other contractor characteristics.

In order to characterize what products are green, the survey used the expertise of the Partnership for Advancing Technology in Housing (PATH), which is a voluntary partnership between leaders in the home building, product manufacturing, insurance, and financial industries and representatives from Federal agencies concerned with housing. In 2007, PATH created a list of the top ten technologies with the "most promise for making our existing homes more durable, stronger and more resource efficient." In addition to these products, the survey also included ten products which had been featured on HGTVPro's website under "Green Building." Each of the products chosen had an entry in the Technology Inventory website, which is run through ToolBase Services with the help of the NAHB Research Center. The Technology Inventory website categorizes each product along certain dimensions, including Energy Efficiency, Quality and Durability, and Environmental Performance. Product categories were not listed in the actual survey. Respondents

were not asked what they thought about "energy efficient products," but instead they were asked for their thoughts on "tankless water heaters" and "high performance windows," which in the analyses were classified as energy efficient. This helped avoid response bias.

For each selected product, each respondent was asked whether or not they had installed the product in recent years. Respondents were also asked if they thought government policies dictate the product usage, promote their adoption, have little or no effect on their use, or actually hinder their use. This allowed the creation of an index of product use and degree of government support. The list of all 22 individual products, how they were categorized, and their index scores are listed in the Appendix.

In addition to the product-specific questions, respondents were also asked about green remodeling in general. These questions were designed to touch on four topics: the interest in green products relative to more traditional remodeling products, the level of green certification, the share of projects with specifically mentioned green goals, and whether the client or the contractor generally initiated the green focus.

In February 2009, Specpan sent out 1,064 surveys and received 265 usable responses, which translates to roughly a 25 percent response rate. Of those who responded, 80 percent were general full-service remodeling contractors, 9 percent were handymen, and an additional 6 percent were design/build firms. Only 4 percent were special trade contractors. Given the generalist nature of the respondents, most could be expected to have knowledge of a broad range of green remodeling projects and products.

Analysis

Using the information collected from the survey, this paper first describes the level and variation in use by product and product category then examines the level of government support to help explain that variation. In addition, contractor characteristics are used to explain the variation in use by firm, as well as the variation in the relative sales of a company's green remodeling products.

Product Use and the Effect of Government Support

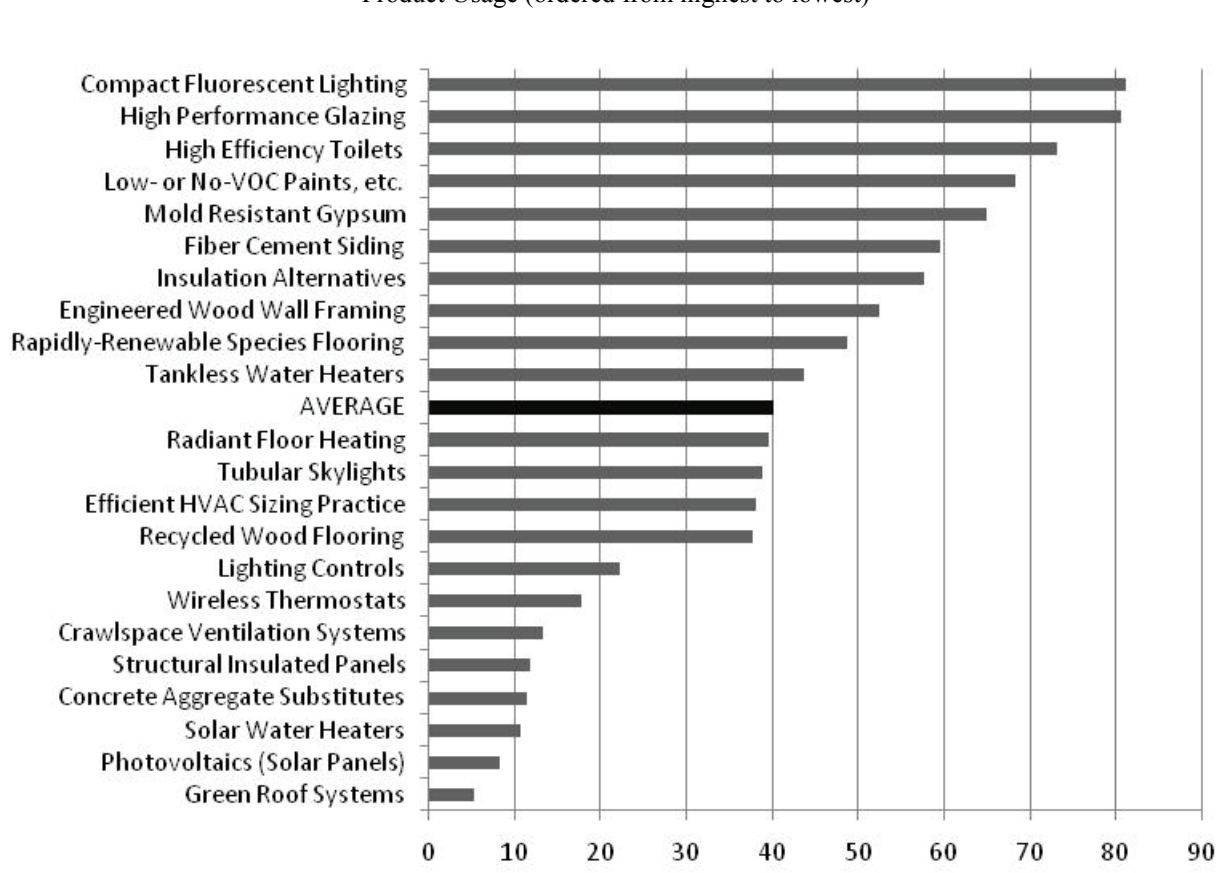
The product usage index is the share of respondents who installed a given product. This rate ranged from a high of 81 for compact fluorescent lighting to a low of 5 for green roof

systems, with an average of 40 for the products included in the survey and a standard deviation of 24.9 (see Figure 5a).

The average of these scores can also be found across their product categories (see Figure 5b). The categories of Energy Efficiency, Quality and Durability, and Environmental Performance had a minimum of 10 products in each, although a product could be in multiple categories. How each product was categorized can be found in Appendix A. The Energy Efficiency category has the lowest average usage index score at 34.[2] While this result may be surprising because products like compact fluorescent lights and high performance windows are becoming mainstream, other energy efficient products are not nearly in such demand. For example, some products, such as solar energy or automatic lighting controls, which are not clear substitutes for traditional remodeling products, have usage scores under 20. In a way, this supports Russell's finding that consumers are willing to opt for the more energy efficient model whenever they are replacing their current product, but in general, consumers are not actively making their homes more energy efficient independent of replacement cycles. Consequently, the variation in usage rates within the Energy Efficiency category was high (standard deviation of 25.6). The Environmental Performance category also had a high standard deviation (27.5), but it also had a high average usage rate (40 percent). The Quality and Durability category had both the highest average usage rate (41 percent) and lowest variation (standard deviation of 22.7), indicating the value consumers place on dependability.

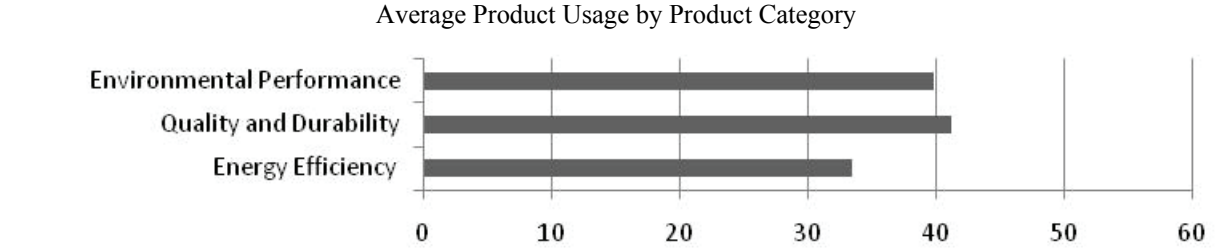
[2] Undoubtedly, the specific products selected to be included in the survey influences the average usage index scores. Using a different list of products would probably result in slightly different average scores, but would also likely show similar patterns.

Figure 5a: Use Varies Widely by Product



Source: JCHS National Green Remodeling Survey, February 2009

Figure 5b: Durable and High Quality Products Most Preferred



Source: JCHS National Green Remodeling Survey, February 2009

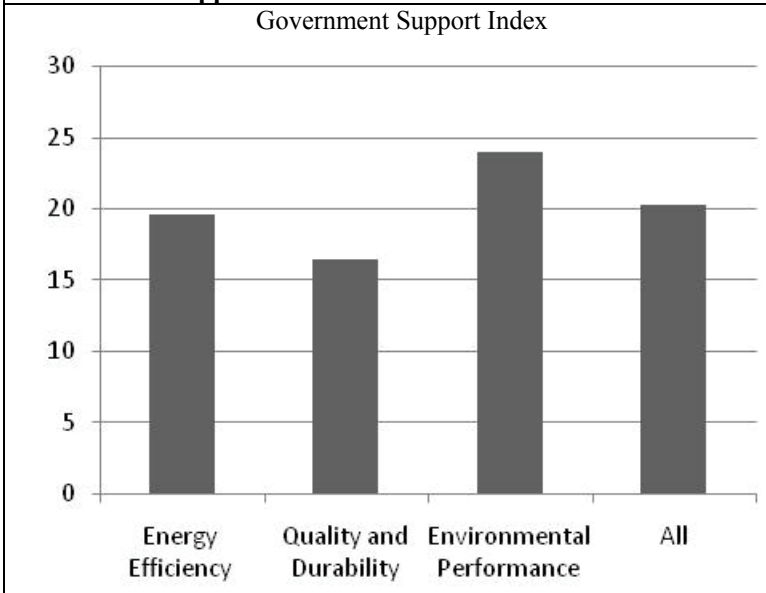
Another consideration is the role of public policies in promoting or hindering the use of specific products or product types. In some cases, these rules dictate that for a certain type of remodeling project only certain products can be used or incentives are in place to encourage their use. In other cases, local ordinances discourage the use of nontraditional products. For example, 41 percent of respondents who installed high efficiency toilets did so because they said their use was required, and 61 percent of respondents who installed photovoltaic solar panels said their

use was promoted. Meanwhile, 4 percent of respondents who installed solar water heaters said government regulations hindered their use, possibly because local zoning ordinances may discourage nontraditional home facades. In order to measure the level of support or discouragement of an individual product, this paper uses an index equal to the share of respondents who installed a given product who reported its use was required, plus half the share saying it was encouraged, and minus the share saying it was hindered by regulations.

> Government Support Index = (% of respondents who installed a given product saying use was dictated) + ½(% saying use was promoted) – (% saying use was hindered).

The score for each product is also included in Appendix A. High efficiency toilets had the highest level of government support (55), while tubular skylights and wireless thermostats had the least support (5). The average across all products was a score of 19 (see Figure 6). This index of government support was averaged across product categories similar to the usage rate. The Environmental Performance category had the highest average level of government support, while Quality and Durability had the lowest. The high support for environmentally sustainable products is logical because these products have less clear benefit to the individual consumer, at least when compared to energy efficient products that have lower operational costs and high quality products that have longer life spans.

Figure 6: Environmentally Sustainable Products Receive the Most Government Support

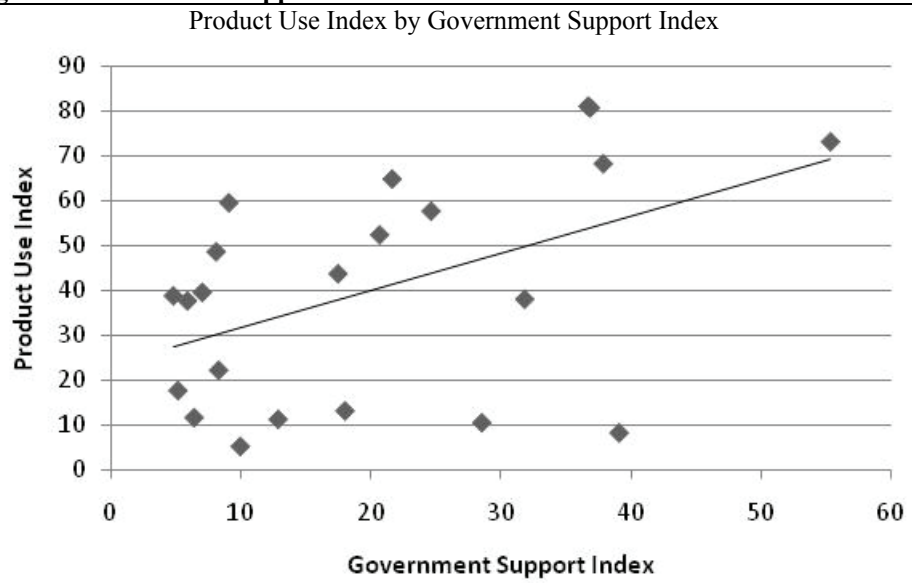


Source: JCHS National Green Remodeling Survey, February 2009

Comparing this support index to the usage and adoption scores shows the effect of government regulations. There is a strong correlation between the level of public policy support for a product and its usage (see Figure 7). This relationship has a correlation coefficient of 0.476 and is statically significant (p-value of 0.025). Consequently, government support does seem to have a significant impact on product use.

Looking at products that deviate from this correlation between policy support and usage is also helpful. The consumer demand, or lack thereof, for these products presumably is offsetting the degree of government support. For example, solar panels and solar hot water heaters had unusually low rates of use for their level of government support (i.e. fall below the trend line). Possible reasons for this under-use could include the high upfront cost to consumers. A tax credit for solar energy has been in place in some form or another since 1978, and the current 30 percent credit will remain in effect until at least 2016. Recouping the cost of installing solar energy requires working through the tax code and not receiving the refund until filing taxes; in the meantime, consumers will be faced with upfront costs that may alter their behavior. These are also not merely green substitutes for traditional products, as they require an active effort to use new green technology. In addition, solar energy products have been conspicuous on rooftops, although new building-integrated photovoltaics (BIPV) hope to avoid aesthetic concerns. On the other hand, gypsum products and fiber cement siding were substantially above the trendline. Consumer demand has been sufficient to increase use of these products and is likely driven by more reasonable upfront costs and the fact that they are easily substituted for traditional products.

Figure 7: Government Support Leads to Increased Product Use



Source: JCHS National Green Remodeling Survey, February 2009

Contractor Use and Performance

Consumers do not make choices in a vacuum. The options the contractor presents may affect the decision of their clients. Even when individuals know what project they want to undertake, their decision will influence the type of contractor they seek out. While the causality is difficult to determine, understanding the basic characteristics of contractors taking on green remodeling projects is still important. Many of the characteristics are intertwined, making the recognition of the meaningful characteristics difficult. A long series of cross-tabulations could help illustrate the different relationships, but simple regressions are also helpful. Selected characteristics are used to explain the extent of a contractor's use of green remodeling products, measured by the share of surveyed products installed in recent years as well as the performance of their green remodeling products relative to the contractor's overall business. These models are not necessarily meant to be causal or predictive, but they are simply designed to isolate the statistically significant relationships among the many complicated interactions. The independent variables are all expressed as dummy variables and are described below along with their predicted relationship to product use and relative sales.

Company Size: Larger companies, defined as those with remodeling revenue over $500,000 last year, are predicted to have higher levels of product use simply because more revenue indicates more projects were installed, and there were, therefore, more opportunities to

use these products. Twenty-three percent of respondents had annual revenue over half a million dollars, and this figure is comparable to the 22 percent of contractors in this revenue range according to the Census Bureau's most recent Economic Census of Construction.

Project Size: Companies with larger typical projects, defined as costing over $25,000, are predicted to have higher green product usage rates. According to *Remodeling* magazine, nearly half of contractors said that a green remodeling project costs 11% to 25% more than a regular project, with the remaining contractors evenly split above and below that range. Another study found that green products could be particularly desirable when such products actually cost more than their traditional substitutes due to some consumers' desire for greater social status (Griskevicius, Tybur and Van den Bergh). Contractors who typically have larger projects with more upper-end products and projects where conspicuous consumption may be a motivating factor may, therefore, be more involved in the green market. Thirty-one percent of contractors are classified as having larger typical projects.

Region: Contractors in the West are predicted to use green products more frequently because of competition from green products used in new home construction. According to a survey by McGraw-Hill Construction, 60 percent of home builders in the West will have more than 60 percent of their projects be green by 2009, compared to an average of only 36 percent of builders nationwide (McGraw-Hill Construction 2008). The collapse of the housing industry, however, especially in the West, could mean that green remodeling in that region is faring poorly, even compared to the overall industry. Respondents were located throughout the country, with a low of 16 percent in the West and a high of 32 percent in the Midwest. In this model, dummy variables for the South, West, and Midwest Census regions are included, with the Northeast used as the reference.

Specialization: Contractors who specialize in green projects, meaning over half their projects had energy efficiency or environmental sustainability mentioned specifically as a project goal, are predicted to use green remodeling products more often. In addition, their knowledge and expertise in green remodeling should lead to stronger performance of their green business. Seventeen percent of respondents were classified as green specialists.

Certification: Similar to green specialization, contractors who completed green remodeling certification programs or regularly had their projects certified as green were expected to have higher rates of green product use and have their green business perform better. Only 11

percent of contractors reported having some form of green certification. One might expect that these green certifications would overlap significantly with green specialization, but that does not seem to be the case (see Figure 8). Only roughly 40 percent of green certified contractors in this survey are also green specialists, and less than a quarter of green specialists are certified. Company size is a strong indicator of certification, with 23 percent of larger companies reporting some type of certification. These larger companies may simply have the resources to obtain certification, but they are not necessarily focused on green remodeling. Self-proclaimed "green remodelers" will continue to rely on their specialized knowledge and expertise until a universal standard for certification is accepted. Specialization in green remodeling is predicted to have a stronger relationship to use and relative green sales than green certification.

Figure 8: Surprisingly, Green Certification and Specialization Overlap Little

	Green Certified	Non-Certified	Total
Green Specialists	4%	13%	17%
Non-Specialists	6%	77%	83%
Total	11%	89%	100%

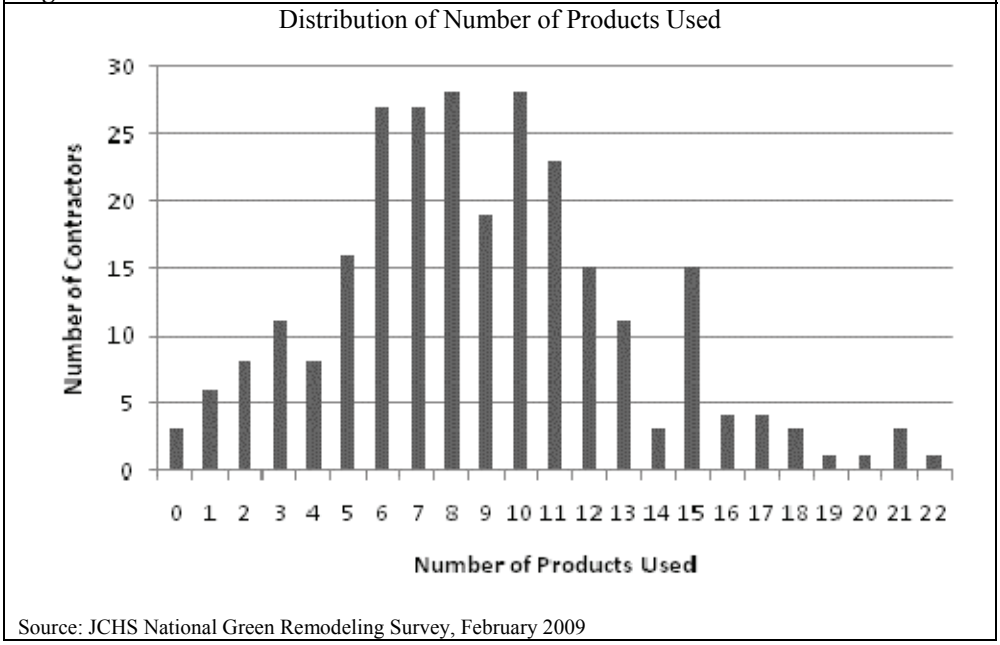
Note: Totals may differ due to rounding.
Source: JCHS National Green Remodeling Survey, February 2009

Initiative: There is some debate about whether the green remodeling industry is being led by consumers or contractors. This paper tests both ideas using two dummy variables: one for respondents who said they generally initiated the focus on energy efficiency and environmental sustainability and another for respondents who said their client usually initiated the focus. The reference group for this variable is the contractors who said the focus was about equal. Contractors who actively promote green remodeling products are predicted to have higher rates of green products and have their green business perform better. Meanwhile, contractors who were passive or hesitant about green remodeling and relied on their clients to initiate the focus are expected to have lower scores on both dimensions. Twenty-two percent of respondents said their company initiated the focus on green, while 29 percent said it was generally initiated by their client.

Contractor Use. The contractor use index is based on the number of products a given contractor installed, up to all 22 products. The distribution of contractor use approaches a normal distribution (see Figure 9). The index is equal to the number of products used as a share of all products surveyed, ranging from 0 to 100. Contractors used an average of 40 percent of products surveyed (8.8 products), with a standard deviation of 19.4. This index can also be created for the

product categories, where the number of products used within a given category is divided by the total number in that category.[3]

Figure 9: Most Contractors Use Some Green Products



Source: JCHS National Green Remodeling Survey, February 2009

After estimating a regression model, the overall model proves statistically significant and has an adjusted R-squared value of 0.238 (see Figure 10). The single most important variable associated with higher overall levels of green product use is green certification. Contractors who are green certified had a contractor use index score 17 points higher than non-certified contractors. Green specialists were also associated with statistically significant higher levels of use (6.5 points). In addition, larger companies had higher usage scores (10 points), but again, this is likely driven by the fact that higher revenue implies more projects and, therefore, more opportunities to use these products. Whether the contractor or the client initiated the focus on green was not significant, nor was the region in which they operate. Restricting the sample to general contractors does not substantially change the results.[4]

[3] Energy Efficiency has a maximum of 14 products, Quality and Durability has 12, and Environmental Performance has 13.

[4] The overall model remains statistically significant when restricting the sample to general contractors, and the Adjusted R-Squared figure rises to 0.244. Green certification, green specialization, and company size are again the only statistically significant independent variables, with coefficients of 15.870, 7.739, and 10.227, respectively.

Figure 10: Linear Regression Results for Overall Contractor Use			
Observations			265
F-Value			10.150
P>F			0.000
Adjusted R-Squared			0.238
	Coefficient	t	P>|t|
Green Certified	**17.125**	**4.780**	**0.000**
Green Specialist	**6.588**	**2.250**	**0.025**
Client Initiates Green Focus	-1.027	-0.410	0.682
Company Initiates Green Focus	-2.549	-0.940	0.349
Larger Companies	**10.062**	**3.320**	**0.001**
Larger Projects	4.493	1.640	0.102
South	2.953	1.050	0.293
Midwest	2.257	0.840	0.404
West	5.283	1.600	0.111
Constant	32.094	13.460	0.000

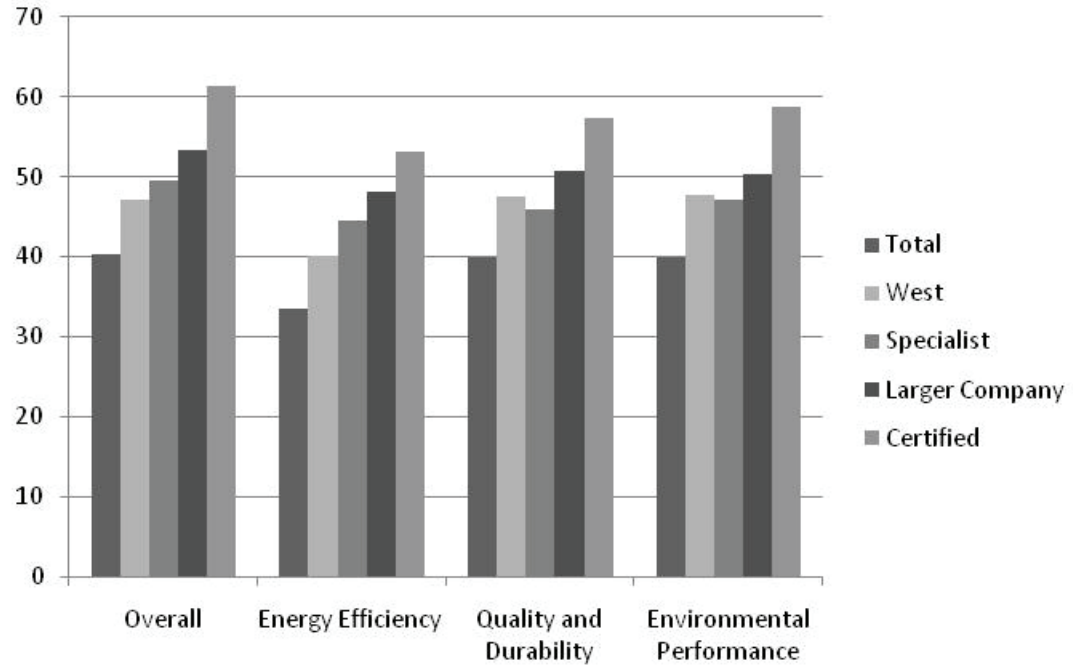
Note: Bold font indicates statistically significant independent variables.
Source: JCHS National Green Remodeling Survey, February 2009

Dividing the sample into green certified contractors and non-certified contractors then comparing the simple product usage rates reveals that green certified contractors were more likely to use every product in the survey, and such contractors had especially high product usage rates in recycled wood flooring, fiber cement siding, and engineered wood. Green specialists appeared to favor concrete aggregate substitutes and structural insulated panels. Larger companies have exceptionally above average use of automatic lighting controls and tankless water heaters. All three contractor characteristics (certification, specialization, and revenue) were associated with higher levels of use of radiant floor heating and efficient HVAC sizing practices.

This model can also be applied to the contractor use index for the different product categories (see Appendix B). Overall, the pattern is very similar. Green certification is the most substantial and significant factor. Company size and green specialization are significant throughout and are most substantial for Energy Efficiency products. The West becomes significant and relatively substantial (7 points) for both Quality and Durability and Environmental Performance products. Products that had substantially above average use in the West include tubular skylights and flooring from rapidly-renewable species. Figure 11 shows the average index score, including the scores for specific product types, by the significant contractor characteristics.

Figure 11: Green Certified Contractors Use the Most Green Remodeling Products

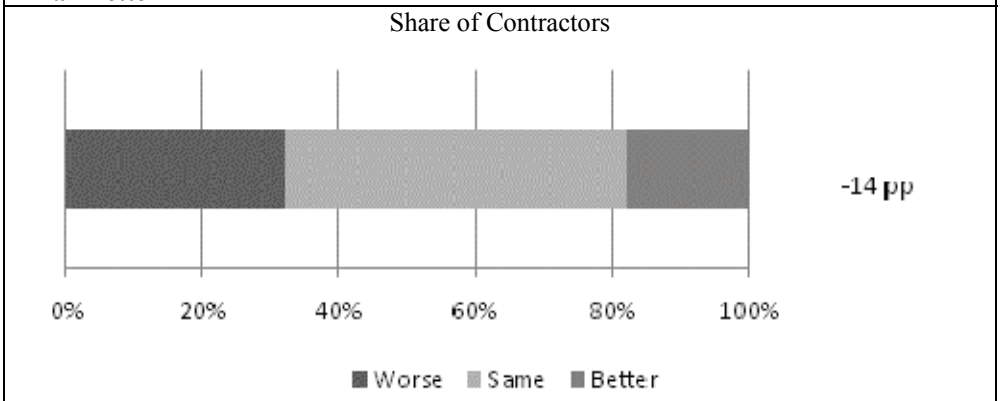
Contractor Use Index by Significant Contractor Characteristics



Source: JCHS National Green Remodeling Survey, February 2009

Relative Sales of Green Products. From a business perspective, perhaps the most important question is how green remodeling products perform relative to the overall remodeling industry now that the economy is in recession. One possibility is that the operational savings for some green remodeling products increases their demand during times of financial distress. Another thought is that these products are a luxury and discretionary expenditure that will be abandoned during hard times. In this survey, 32 percent of respondents said their green products were faring worse than their regular business, including 9 percent who said much worse. In comparison, 18 percent said their green business is doing better, including only 2 percent who said much better. The net difference between those saying sales were better and those saying worse is a negative 14 percentage points, indicating that green remodeling products seem to be faring worse in the current recession (see Figure 12). Respondents who had no green projects or were entirely green were excluded, so only respondents with a mix of both green and traditional projects are examined.

Figure 12: More Contractors Said Green Products Were Faring Relatively Worse Than Better



Note: Net performance equal to share of contractors saying green products are faring better than overall business, less the share saying they are faring worse. pp=percentage points
Source: JCHS National Green Remodeling Survey, February 2009

In order to analyze the performance of green remodeling products, an ordered logit regression model is used, with dependent variable values of -1, 0, and 1, where -1 means sales of green products are faring worse than a contractor's regular business, 0 meaning green products are faring the same, and 1 meaning those products are actually faring better. Again, the contractors who did not complete any green projects or were only green were excluded to make the relative sales performance index meaningful.

Overall, the model is statistically significant but with a fairly low R-squared value (0.081). The results show that specialization has a statistically significant correlation with improved relative business performance of green products (see Figure 13). The odds of having green products perform better than your overall business are 5.35 times greater for green specialists than for non-specialists.[5] Green certification and being located in the West are not statistically significant in this model. Instead, contractors in the Midwest were statistically more likely to have better green sales, at least when compared to the Northeast. This result is surprising but supported by anecdotal evidence of greater interest in green remodeling among contractors in that region.

Interpreting the coefficients and odds ratios from an ordered logit regression can be confusing, but simply charting the actual survey response for these statistically significant characteristics does show the substantial relationship between being a green specialist and better performance of green products (see Figure 14). Nearly half (48 percent) of green specialists said

[5] Similarly, the odds of having green products fare as well as your overall business, as opposed to worse, are also 5.35 times greater for green specialists.

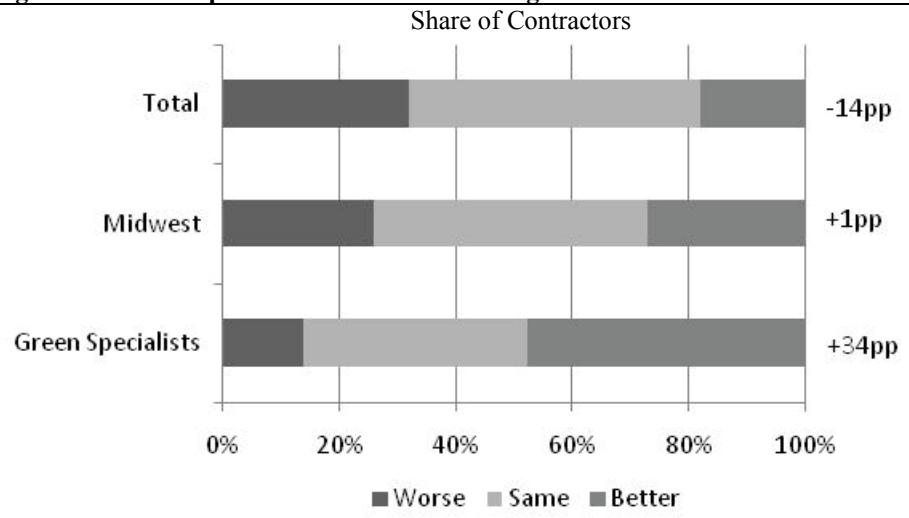
their green products were doing better, compared to 14 percent saying worse. In the Midwest, the split was just about equal, but it was still much better than the overall pattern of green product performance.

Figure 13: Relative Sales Ordered Logit Regression Results

Observations				222
Chi-Squared Value				36.840
P>Chi-Squared				0.000
Pseudo R-Squared				0.081
	Coefficient	Odds Ratio	z	P>|z|
Green Certified	0.311	1.365	0.760	0.449
Green Specialist	**1.677**	**5.348**	**4.480**	**0.000**
Client Initiates Green Focus	-0.177	0.838	-0.560	0.573
Company Initiates Green Focus	-0.007	0.993	-0.020	0.983
Larger Companies	-0.335	0.715	-0.890	0.373
Larger Projects	0.500	1.648	1.470	0.141
South	0.241	1.272	0.680	0.495
Midwest	**0.829**	**2.290**	**2.400**	**0.016**
West	0.294	1.342	0.730	0.466
cut1	-0.133			
cut2	2.476			

Note: Bold font indicates statistically significant independent variables.
Source: JCHS National Green Remodeling Survey, February 2009

Figure 14: Green Specialization Leads to Stronger Performance of Green Products



Note: Net performance equal to share of contractors saying green products are faring better than overall business, less the share saying they are faring worse. pp=percentage points
Source: JCHS National Green Remodeling Survey, February 2009

Conclusion

Green remodeling is still a niche market, but it has proven successful in making America's housing stock more energy efficient over time. This paper uses a survey of remodeling contractors to examine the role of government regulations in promoting the use of green products, as well as whether certain contractor characteristics are associated with higher levels of green product use.

The analysis shows that government regulations favor environmentally sustainable products over other green categories, and these policies have a positive effect on the use of green remodeling products in general. Consequently, changes in public policies can produce meaningful changes in the marketplace, and contractors would be wise to follow the politics of green technology in an effort to gauge potential future demand. On other hand, sometimes even strong government support is not sufficient to encourage substantial use. Despite a sizeable tax credit for solar energy, photovoltaics and solar water heaters are still relatively rare. Possible reasons for this under-use include the high upfront cost consumers face and the perception of conspicuousness associated with roof-mounted solar panels. In addition, consumers seem less likely to actively obtain additional products that would improve the energy efficiency and environmental sustainability of their home but are not strictly substitutes for traditional products.

Contrary to the view that green project goals are simply "greenwashing" traditional remodeling projects, contractors who reported that energy efficiency or environmental sustainability is a stated goal for the majority of their projects are in fact more likely to use the green products included in this survey and have their green business perform as well as or better than their overall business. Green certification is associated with the wider use of green remodeling products, but these products do not necessarily sell better than traditional products for green certified companies. This may be due to the lower profile of certification programs, especially when compared to those in the home building industry. As certification programs gain recognition and remodelers promote themselves by using their certification, the benefit to holding such certification will likely increase. Larger companies use more of the green products surveyed, but this may simply be because they have more projects and therefore more opportunities to use these products. Contractors in the Midwest were more likely to report that their green products were performing as well as or better than their overall business.

The Joint Center for Housing Studies of Harvard University with the help of Specpan plans to continue administering surveys on green remodeling. These surveys will provide the foundation for a variety of future research on green remodeling. An effort to link the respondents in this survey to an earlier survey administered in August 2008 resulted in an insufficient sample size for strong analysis. Working with Specpan to target past respondents could result in a time-series database through which products could be tracked as they gain or lose popularity. Furthermore, expectations of future consumer interest in one period could be evaluated to see if they are manifested in later periods. Similarly, some contractors wonder about the effect of expectations on future government regulations to promote green products. Another topic of interest to remodeling firms is consumer price sensitivity with regards to green products. Three-quarters of contractors said green remodeling projects cost 10 percent or more above a regular project, and 63 percent said the additional cost for going green was greater than what their clients were willing to spend. Finding more information about the true and assumed cost of the surveyed products would complete a vital missing variable in this analysis. In addition, these surveys could help track the growth in green remodeling certification programs, including the value they add to a firm or project and the variation in certification by region. Finally, due to the multitude of confounding factors that might be influencing these findings, a case-study approach of more intense surveying of a smaller, targeted population would be helpful. For example, contrasting the experiences of

green remodeling professionals in California, where green new home construction is substantial, to Minnesota, where contractors appear disproportionately passionate about green remodeling, and to a state in the Middle Atlantic region, where contractors are less enthusiastic about green remodeling, might help illustrate the underlying factors driving these trends. A more concentrated survey with a higher response rate might also exhibit what response bias, if any, might be affecting research conclusions.

Appendix

A. List of Products, Index Scores, and Product Categorization

PATH TOP TEN		Toolbase Name	Usage	Government Support	Energy Efficiency	Quality and Durability	Environmental Performance
1	Air Sealing	Insulation Alternatives: Blown or Foamed Through a Membrane	58	25	X		
2	Smartvent Ventilation/Ventilation Control System	Crawlspace Ventilation Systems	13	18	X	X	X
3	HVAC Sizing - Right-sized HVAC	HVAC Sizing Practice	38	32	X	X	
4	High Efficiency Toilets	Toilets - High Efficiency Toilets (HET)	73	55			X
5	Compact Fluorescent Lighting	Compact Fluorescent Lighting	81	37	X	X	
6	High Performance Windows/Storm Windows	High Performance Glazing	81	37	X		X
7	Wireless Lighting, Thermostats, and Other Controls	Lighting Controls	22	8	X		
		Wireless Thermostats	18	5	X		
8	Solar Hot Water	Solar Water Heaters	11	29	X		X
9	Recycled/Renewable Flooring	Recycled Wood Flooring	38	6		X	X
		Wood Flooring From Rapidly-Renewable Species	49	8		X	X
10	Tubular Skylights	Tubular Skylights	39	5	X	X	
		Low- or No-VOC Paints, Finishes and Adhesives	68	38			X
		Tankless Water Heaters	44	18	X	X	X
		Mold Resistant Gypsum Panel Products	65	22		X	X
		Engineered Wood Wall Framing	52	21		X	X
		Fiber Cement Siding	60	9		X	
		Structural Insulated Panels	12	6	X		
		Radiant Floor Heating	40	7	X		
		Photovoltaics (Solar Panels)	8	39	X		X
		Concrete Aggregate Substitutes	11	13		X	X
		Green Roof Systems	5	10	X	X	X

B. Product Category Regression Results

Regression Results for Contractor Use of Energy Efficiency Products			
Observations			265
F-Value			11.560
P>F			0.000
Adjusted R-Squared			0.265
	Coefficient	t	P>|t|
Green Certified	14.088	4.020	0.000
Green Specialist	8.431	2.950	0.003
Client Initiates Green Focus	-1.856	-0.760	0.448
Company Initiates Green Focus	-1.053	-0.400	0.692
Larger Companies	12.341	4.170	0.000
Larger Projects	5.124	1.920	0.056
South	1.848	0.670	0.501
Midwest	1.794	0.680	0.497
West	3.724	1.150	0.250
constant	25.268	10.840	0.000

Regression Results for Contractor Use of Quality and Durability Products			
Observations			265
F-Value			7.230
P>F			0.000
Adjusted R-Squared			0.175
	Coefficient	t	P>|t|
Green Certified	17.125	4.780	0.000
Green Specialist	14.719	3.940	0.000
Client Initiates Green Focus	3.768	1.240	0.217
Company Initiates Green Focus	0.640	0.250	0.806
Larger Companies	-4.311	-1.520	0.129
Larger Projects	6.629	2.100	0.037
South	6.203	2.180	0.030
Midwest	3.977	1.360	0.175
West	2.345	0.830	0.405
constant	7.029	2.040	0.042

Regression Results for Contractor Use of Environmental Performance Products			
Observations			265
F-Value			5.990
P>F			0.000
Adjusted R-Squared			0.146
	Coefficient	t	P>|t|
Green Certified	16.402	4.090	0.000
Green Specialist	4.893	1.500	0.135
Client Initiates Green Focus	-0.510	-0.180	0.855
Company Initiates Green Focus	-3.670	-1.210	0.228
Larger Companies	8.969	2.650	0.009
Larger Projects	0.510	0.170	0.868
South	1.737	0.550	0.580
Midwest	2.451	0.810	0.417
West	7.489	2.030	0.044
constant	33.573	12.600	0.000

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