# A Method of Estimating the Impacts of Climate Change on Oregon Household Budgets

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**Abstract**

Climate change communication faces challenges in polarized media environments. While economic framing generates stronger public engagement than health or geographical approaches, most analyses focus on macroeconomic outcomes rather than household budgets. This paper addresses that gap by estimating climate change impacts on typical Oregon household budgets. Synthesizing literature on sectoral price changes and consumer demand, I develop a translational framework making economic consequences accessible to non-experts. Results indicate that by 2050, medium-income households will experience annual welfare losses of $9,525, representing 9.1% of income. This household-level analysis helps communicate climate change's tangible economic effects to the public.

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# 1 Introduction

Climate change presents one of the defining challenges of the 21st century, yet communicating its expected impacts to the general public remains difficult. While the scientific consensus on climate change is robust, the United States faces a highly polarized and fragmented media environment, particularly around climate science (Bolsen and Shapiro, 2017). Research suggests that economic issues generate substantially larger climate-change-related engagement than health or geographic concerns (Li and Su, 2018; Bertolotti et al., 2021). However, most economic analyses of climate change focus on macro- or sectoral-level outcomes, creating a disconnect between abstract forecasts and the tangible effects households can expect to experience. Indeed, while a 2023 report from the U.S. Treasury listed a number of mechanisms through which U.S. household finances may be impacted by climate change, it does not include any specific estimates (U.S. Treasury, 2025).

This leaves a critical gap: the direct, everyday financial impact on households. In this paper, I attempt to produce a 'reasonable' estimate of that impact for typical households by synthesizing a simple model of household expenditures with sectoral-level estimates of climate change impacts. Of course, to-date the research in this area has generally not been designed to be applied in this way, and significant assumptions are necessary in order to produce any estimate at all. For this reason, the main question posed by my analysis is more appropriately framed as: "how heroic are the assumptions needed to produce an estimate of household-level impacts?"

I start by using the Almost Ideal (AI) demand system of Deaton and Muellbauer (1980) which is a flexible specification of consumer demand in the form of budget shares. One appealing advantage of the AI approach is its ability to flexibly model patterns of substitution and complementarity between goods without enforcing strong priors – in the climate change context, the AI demand system can be thought of as incorporating at least a degree of adaptation as prices change. I use preference parameter estimates from Taylor (2010) along with data from the 2023 Consumer Expenditure Survey (CEX) to create 'typical' households based on average expenditure patterns across three income groups. I draw from the literature, making passthrough and related assumptions as required, to create forecasts of price changes attributable to climate change by the decade 2040-2050 for each of the major CEX categories, and then simulate the impact of those price changes for each of the household types modeled. As estimates of housing market changes vary substantially across geography, I assume the households I model are in Oregon.

The simulation results indicate that households will increase spending by roughly 5-6%, and decrease savings rates by 4-7%. Quantities consumed decrease by 2%-5%. Lower-income households are affected more than higher-income households, driven by changes in the relative budget shares across households. However, the assumptions required may lead one to reasonably doubt these results. I conclude with a broader discussion of the ways researchers could improve the usability of climate change forecasts.

This paper sits between three broad strands of the literature concerning the economic effects of climate change. The first is the ongoing effort to understand and model the impacts of climate change at large scales (Tol, 2009). These approaches generally use variation in temperatures aggregated to some geographic unit (e.g. country-level) to identify the responsiveness of economic activity to climate and then forecast future economic outcomes using models of future climate conditions (Deschênes and Greenstone, 2007; Burke et al., 2015; Akyapı et al., 2025). Within this literature, there is disagreement about the role of technological adaptation (Cruz and Rossi-Hansberg, 2024; Nath et al., 2024), the differing roles of temperature and precipitation (Kahn et al., 2021), and the strategy used to estimate climate damage functions (Bilal and Känzig, 2025), among other issues. These differences result in estimates of welfare losses due to climate change that differ by an order of magnitude.

The second consists of efforts to focus on individual sectors of the economy. These papers often follow a similar analytical pattern to the more aggregate analyses discussed above. For example, Kotz et al. (2024) use price and temperature data to evaluate the relationship between weather conditions and agricultural sector outcomes, and then forecast future outcomes based on various atmospheric models. I discuss several of these papers below when I employ them as inputs to my analytic framework.

Finally, these is an existing literature on the impacts of climate change and adaptation at the household level. Much of this literature focuses on households in specific countries (Ngoma et al., 2021; Zhang et al., 2022), often with an additional focus on the agricultural sector (Mekonnen et al., 2021) or energy consumption (Goldstein et al., 2020; Zhang and Xu, 2025). Other studies focus on adaptation behaviors, again largely in the space of energy and water consumption (Bichard and Kazmierczak, 2012; Nauges and Wheeler, 2017). A recent strand of investigation has focused on the role of homeowners insurance markets in hedging risk and incentivizing adaptation (Boomhower et al., 2024; Oh et al., 2025). In a working paper, Clausing et al. (2025) aggregate insurance claim, cooling, and mortality data to form a partial estimate of household-level costs across counties. They estimate average annual costs ranging from $400 to $900 from these sources; my estimates are roughly an order of magnitude higher.

The challenge for communicators is the lack of a comprehensive framework translating sectoral analyses and forecasts into effects on household decisions. The analysis I present here is an attempt to fill that gap with an explicit model of substitution across consumption categories.

I proceed in Section 2 by detailing the challenges that give rise to this gap. I present the Almost Ideal demand system in Section 3 and detail the estimates that I use from the literature in Section 4. In Section 5 I discuss my results; I conclude in Section 6.

## 2 From Physical Risks to Household Budgets

To understand why household-level climate impact estimates are scarce, it is useful to contrast climate change with a simpler policy intervention where such estimates are routine. Consider a sales tax increase on a specific good. Producing "reasonable" household impact estimates is straightforward because: (1) there is consensus on the theoretical linkage (taxes pass through to prices, prices affect demand), (2) standard methodologies exist to estimate pass-through and demand parameters under broadly accepted assumptions, (3) required data on prices, quantities, and household characteristics are routinely collected, and (4) the causal chain from policy to outcome is short and transparent. For example, Grainger and Kolstad (2010) use Consumer Expenditure Survey data to estimate the incidence of a carbon tax across households in different income deciles.

Climate change often lacks these elements. As a physical process, its economic effects flow through multiple layers of physical and behavioral changes before standard economic models apply. Consider food expenditures: climate change affects agricultural operations, which respond through altered planting decisions and land use patterns, which determine wholesale prices, which pass through imperfectly to retail prices, which finally influence household decisions. Each step involves complex interactions, and these assumptions stack—the failure of one likely invalidates downstream applications of others, even when conditionally valid. Unlike observable policy changes, climate changes unfold gradually and simultaneously across sectors and geographies, making it difficult to isolate effects or validate assumptions.[1] The counterfactual—a world without climate change—becomes increasingly difficult to specify as effects compound.

The challenge intensifies when moving from sectoral to household-level analysis. Sectoral studies typically focus on production-side effects with limited action sets—such as agricultural output under constant land use, or energy capacity under fixed infrastructure—rather than consumer-facing prices. Translation to households requires three additional inference layers.

First, production shocks must be translated to consumer prices. Pass-through depends on market structure, competitive dynamics, and regulatory responses—all potentially altered by climate change. A drought reducing crop yields might cause proportional price increases in competitive markets, but oligopolistic suppliers may absorb or amplify costs strategically. Infrastructure adaptation investments might be financed through taxes, utility rates, or private capital, each with different consumer price implications.

Second, household analysis requires modeling simultaneous price changes across multiple goods. This differs from simply scaling aggregate estimates; households exhibit different consumption patterns and price sensitivities than representative agents in macro models. Cross-price elasticities become critical: as food prices rise, households may substitute toward other goods, but which ones? These substitution patterns vary across the income distribution and may be constrained by necessities. A low-income household spending 30% of income

[1] Further difficulties arise since attribution of specific weather events to climate change remains challenging (Barry and Chorley, 2009).

on food faces different adjustment possibilities than a high-income household spending 10%.

Third, the temporal dimension complicates household analysis. Aggregate models focus on long-run equilibrium effects, but households experience climate change as a sequence of price changes, income shocks, and adaptation opportunities. The dynamic path matters for welfare in ways not captured by steady-state comparisons. Households that can gradually adjust consumption, relocate, or invest in adaptation face different impacts than those forced to respond immediately.

These challenges are compounded by data limitations. While several estimates of aggregate climate damages and some sectoral impacts exist, the literature provides sparse and heterogeneous forecasts of sector-specific price changes suitable for household budget analysis. Existing estimates often focus on different time horizons, assume different climate scenarios, and cover different geographic scales. Some sectors—particularly those involving complex infrastructure—have virtually no consumer price forecasts.

Furthermore, uncertainty multiplies through each inference layer. Physical climate models provide ranges of outcomes, which translate to ranges of production effects, which generate ranges of price changes, which yield ranges of household impacts. By the time one reaches household budgets, confidence intervals often grow too large to provide useful point estimates. Yet policymakers and households need concrete information, creating tension between precision and utility.

Despite these challenges, household-level climate impact estimates remain critically needed. Climate discussions often focus on abstract measures—parts per million of $CO_2$, degrees of warming, or GDP percentage changes—that fail to resonate with non-expert audiences. Translating these into tangible household budget impacts serves an important communication function, even when requiring strong assumptions. The question becomes not whether to produce such estimates, but how to do so transparently about limitations while providing useful information.

# 3 Methodology

## 3.1 The Almost Ideal demand system

I model household consumption decisions with the Almost Ideal (AI) demand system of Deaton and Muellbauer (1980) which has been used to study consumption decisions across a variety of contexts from cannabis (Miller and Seo, 2021) to pharmaceuticals (Bokhari and Fournier, 2013) and mergers (Miller et al., 2016). In the climate context, the AI framework is particularly valuable because it accounts for substitution between categories, capturing at least partial behavioral adaptation without requiring separate estimate of adaptation parameters (Van Valkengoed and Steg, 2019; Noll et al., 2022).

For a representative household, let $w_i$ be the budget share of good $i$. The AI system is the system of equations

$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i \ln \frac{y}{P} \tag{1}$$

where $p_j$ denotes the price of good $j$, $y$ is the household's budget constraint, and $P$ is a Stone-weighted price index defined as

$$\ln P = \alpha_0 + \sum_j \alpha_j \ln p_j + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_j \ln p_i. \tag{2}$$

This framework offers several advantages. First, it provides a first-order approximation to any demand system, making it highly flexible. Second, it can be estimated using linear methods, facilitating replication and extension. Third, the system explicitly models cross-price elasticities, allowing us to capture how price changes in one category (e.g., food) affect consumption of other goods (e.g., transportation). Finally, note that this framework does not explicitly assume a binding budget constraint: depending on the parameterization and observed prices, total spending may be above or below income.

## 3.2 Elasticity estimates

I utilize elasticity estimates from Taylor (2010), who estimated an AI model using a combination of price data from the American Chamber of Commerce Researchers Association

(ACCRA) and consumer expenditure data from the Bureau of Labor Statistics.[2] Table 1 presents the own- and cross-price elasticities across six major consumption categories: food, shelter, utilities, transport, healthcare, and miscellaneous.

**Table 1:** Own- and Cross-Price Elasticities by Major Consumption Category

| | Food | Shelter | Utilities | Transport | Healthcare | Misc. |
|---|---|---|---|---|---|---|
| Food | -0.30 | 0.66 | 0.06 | 0.00 | 0.14 | -0.50 |
| Shelter | -0.11 | -0.83 | 0.19 | 0.19 | 0.28 | -0.58 |
| Utilities | -0.11 | 0.16 | -0.72 | 0.05 | -0.07 | 0.18 |
| Transport | -0.61 | -0.25 | -0.25 | -1.37 | -0.76 | 1.58 |
| Healthcare | -0.78 | 0.00 | 0.43 | -0.01 | -0.94 | 0.83 |
| Misc. | 0.44 | -0.22 | -0.23 | -0.02 | 0.05 | -1.14 |

Notes: Estimates from Taylor (2010).

The elasticities reveal several important patterns. Own-price elasticities (diagonal elements) are negative, as expected, with transportation showing the highest price sensitivity. Cross-price relationships indicate both substitution and complementarity patterns across categories. For example, shelter and utilities exhibit positive cross-price elasticity, suggesting they are substitutes in household budgets. The sign of relationships is not always symmetrical, which is common in empirical AI models.

### 3.3 Representative households

To illustrate differential impacts across the income distribution, I construct three representative household types using data from the 2023 Consumer Expenditure Survey. Table 2 presents the income and expenditure profiles for low-, medium-, and high-income households.

The expenditure patterns reveal substantial heterogeneity across income groups. Low-income households allocate a higher share of their budgets to essential categories such as shelter, food, and utilities. High-income households spend a larger share on transportation and miscellaneous goods. Notably, the low-income representative household exhibits

[2] These estimates are difficult to update due to the lack of availability of more recent price data to pair with consumer expenditure data. I discuss concerns stemming from the vintage of these estimates after presenting the results.

**Table 2:** Representative Household Expenditure Patterns

| | Low Income | Medium Income | High Income |
|---|---|---|---|
| Income after taxes | \$40,621 | \$104,559 | \$211,042 |
| Food | \$4,680 | \$6,917 | \$9,198 |
| Shelter | \$11,196 | \$16,441 | \$27,226 |
| Utilities | \$3,987 | \$5,250 | \$6,415 |
| Transportation | \$7,809 | \$15,914 | \$25,279 |
| Healthcare | \$4,844 | \$7,010 | \$9,633 |
| Miscellaneous | \$16,407 | \$36,390 | \$72,342 |
| Total expenditures | \$48,923 | \$87,922 | \$150,093 |
| Implied savings | -\$8,302 | \$16,637 | \$60,949 |

Notes: Households constructed from the 2023 Consumer Expenditure Survey, Table 1101.

negative implied savings, reflecting the reality that many low-income households balance budgets by borrowing.

### 3.4 Applying price changes

To compute estimates of the effects of price changes on household expenditure decisions, I start by setting the current price index for each sector to 100 and using observed spending to calculate sector-level quantity indices. I then apply the price changes discussed below to each sector, and use the elasticities reported in Table 1 to compute the change in quantities due to changes in prices. I multiply the new quantity and price indices together to get total spending in the category. This procedure holds real income constant, assuming that the effects of climate change occur through price channels rather than labor markets. If, instead, real wages decline in addition to the real price increases discussed below, the model will underestimate the effects of climate change.

I compute compensating variation using the Törnqvist price index (Törnqvist, 1936; Balk and Diewert, 2001), which is exact for translog utility functions. Let $w_{i,0}$ be the initial budget share for category $i$ and let $w_{i,1}$ be the budget share after the effects of climate change are realized, with similar definitions for prices $p_{i,0}$ and $p_{i,1}$. The price index $P_T$ is

$$\ln(P_T) = \sum_i \frac{w_{i,0} + w_{i,1}}{2} \ln\left(\frac{p_{i,1}}{p_{i,0}}\right).$$

and, given initial total expenditures $E_0$, the compensating variation is

$$CV = E_0 \times (P_T - 1)$$

## 4 Sector-level estimates of climate-driven price changes

The most challenging aspect of this analysis involves forecasting climate-induced price changes across the broad consumption categories of the CEX. In this section, I detail the relevant literature for each category and the assumptions necessary to generate a prediction of future price changes. Table 3 summarizes the price changes detailed below.

**Table 3:** Summary of sector-level price change estimates

| Sector | $\Delta P(\%)$ | Source | Notes |
|---|---|---|---|
| Food | 31.2 | Kotz et al. (2024) | Midpoint of reported annual range. |
| Shelter | 5.0 | Sussman et al. (2014) | Median across Oregon forecasts |
| Utilities | 13.4 | Fant et al. (2020) | Estimated median infrastructure spending increase across scenarios. |
| Transportation | 11.0 | Soleimani-Chamkhorami et al. (2024) | Estimated increased infrastructure spending. |
| Healthcare | 6.66 | Jones (2018) | Extrapolated from estimated costs of increased wildfire smoke exposure. |
| Miscellaneous | 10.5 | Kahn et al. (2021); Bilal and Känzig (2025); Nath et al. (2024) | Extrapolated from estimated GDP loss and averaged across papers. |

### 4.1 Food

At first glance, the effect of climate change on food prices may seem to be the easiest to forecast, as considerable effort has gone into understanding the multiple channels through which climate change may affect agricultural output (Zhao et al., 2017). That said, the linkage between output and prices is not one-to-one, especially in developed countries (Gammans and Schaefer, 2025).

I rely on the estimates of (Kotz et al., 2024, fig. 2), who use price index data and fixed-effects regressions to quantify the impacts of climate conditions on food inflation. Note that assumptions are needed to translate these results into forecasts: (a) that estimates stemming from local weather fluctuations can be used to forecast the future effects of global climate change and (b) the estimated effects are constant over time. Averaging their estimates for North America between the SSP1-2.6 and SSP5-8.5 emissions scenarios (IPCC, 2023) results in an annual food inflation rate (net of other inflation drivers) of 1.83%, or 31.2% by 2040.

## 4.2 Shelter

Unlike the other categories I consider, the impact of climate change on shelter costs in a relatively small geographic area like Oregon is potentially ambiguous. Regions with higher climate risks such as wildfires or flooding may face *decreases* in housing costs as individuals relocate to avoid those risks (Bernstein et al., 2019), generating increases in other areas. Some authors have questioned the salience of climate risks to homeowners after finding null results in analyses of risk capitalization (Murfin and Spiegel, 2020).

The estimates I employ come from Sussman et al. (2014), who used a hedonic pricing approach to estimate the effect of climate conditions on housing prices. Similar to other studies, applying these estimates to generate forecasts requires making strong assumptions about the external validity of the estimates over time. They present forecasts for four different climate scenarios incorporating different regional climate and general circulation models. Averaging these estimates for their primary specification results in a nation-wide forecast price decrease of 7.68% for the period 2041-2050.

This forecast, however, is largely driven by changes in the southeastern U.S., where they predict price decreases of 25% or more in many counties. Oregon (and the broader Pacific Northwest region) is often discussed as a “climate haven” and thus net in-migration is likely to provide upwards pricing pressure that may completely offset the effects of increased physical risks. Indeed, across scenarios, Sussman et al. (2014) estimate an average increase in housing prices in Oregon of roughly 5%, which is the number I adopt.

### 4.3 Utilities

This CEX category consists of electricity, natural gas, water, and other services purchased by consumers largely in the context of their home (i.e. it excludes fuels purchased for transportation). Here, once again, a great deal of effort has focused on market trends which will inevitably impact prices (Mideksa and Kallbekken, 2010), such as the growth in electricity demand for cooling purposes (Aroonruengsawat and Auffhammer, 2011; Reyna and Chester, 2017) or the need for infrastructure improvements as both increasing average temperatures and increased variance in temperatures places additional strain on the electricity grid (Dessler, 2025). However, efforts to understand or predict future prices have been limited.

What research does exist largely follows the pattern of using local climate variation to estimate longer-term impacts. In this case, (Zethmayr and Makhija, 2021) use data from electricity consumers in Illinois to estimate that electricity bills will increase by 7.7% by 2050 due to increases in temperature-related consumption alone. While I use this number as an estimate, the analysis is of course incomplete – it ignores both a likely *decrease* in spending on natural gas if cooling-degree days decrease and an increase in infrastructure costs which are generally passed-through to consumers (Fant et al., 2020).

### 4.4 Transportation

The transportation sector represents another area in which much work has been done to contemplate particular forms of the impacts of climate change (see Koetse and Rietveld, 2009, for an early review), but less has been done to produce aggregated forecasts. For example, Neumann et al. (2021) consider the effects of climate change on road and rail infrastructure expenses (on the order of $100 billion per year by 2050, relative to pre-2005 costs), but not how climate change may impact the costs of operations or the cost of building new infrastructure. Houtven et al. (2022) consider costs stemming from damages and disruptions at ports (up to approximately $10 billion per year by 2050), but do not contemplate the pass-through of those costs to households.

Soleimani-Chamkhorami et al. (2024) study a railway in Sweden in much the same way as other papers discussed above: they collect time-series data on maintenance costs and local climate conditions (in this case 18 years), estimate a model, and predict future costs by applying a climate change scenario with associated local climate effects to the estimated model. Across SSP scenarios, they estimate average cost increases of 11%.

Consider the assumptions necessary to apply this figure to this exercise. One must assume that these costs are, in decreasing order of plausibility, (1) passed through to consumers at 100%, (2) reflective of cost changes in the United States, and (3) applicable to all of the components of transportation expenses paid by households. Yet, for the purposes of obtaining some sort of estimate of household-level impacts, I shall adopt all three of these assumptions.

### 4.5 Healthcare

Climate change is likely to have significant deleterious effects on human health globally (Patz et al., 2005). In the United States, work has focused on the effects of extreme weather events on health care utilization (Grant, 2025). Under the assumption that the U.S. health insurance system redistributes the costs involved with increased utilization, it is reasonable to assume that prices faced by households will increase.

In the Pacific Northwest, the most immediately salient effect of climate change on health is likely through the channel of wildfires (Burke et al., 2021) which generate fine particulate matter (Liu et al., 2016) known to affect child development (Klauber et al., 2024) and worker productivity (Chang et al., 2016), among other economic outcomes. I thus focus on wildfire smoke as a first-order approximation.[3] Jones (2018) uses data from the Behavioral Risk Factor Surveillance System to estimate a willingness-to-pay to avoid one day of negative health effects induced by wildfire smoke. In addition to the standard forecasting assumptions made above, I must also assume that such willingnesses-to-pay can be modeled as increased healthcare expenditures for households.

[3] A similarly important effect is heat-related mortality, which many epidemiologists believe is under-counted (Schiffman, 2024).

Of course, under this approach, the degree of increased costs depends on the increase in the number of days households are exposed to wildfire smoke. Several analyses of climate change indicate an increase in the length and severity of Oregon's wildfire season and associated smoke (Halofsky et al., 2020; Stowell et al., 2022; McEvoy et al., 2020; Qiu et al., 2025). Synthesizing these estimates, I estimate a 6.66% increase in healthcare costs associated with climate change, though along with each of the other categories, significant caveats apply.

### 4.6 Miscellaneous

Finally, to estimate a change in the price of the "miscellaneous" category, which represents all goods not captured in the previous categories. In the absence of sector-specific estimates, I construct a crude proxy by averaging GDP loss forecasts from three prominent papers: Kahn et al. (2021), Bilal and Känzig (2025), and Nath et al. (2024). This assumes that aggregate productivity losses translate proportionally to consumer-facing prices in the miscellaneous category – an assumption unlikely to hold but necessary given data constraints. Furthermore, aggregate GDP measures include all of the previous categories, and applying results in this way requires assuming the results apply to this category when considered alone, regardless of the contribution of other categories to aggregate GDP.

Though these assumptions are not likely to hold in practice, it is also unlikely that climate change will not affect the real prices of these goods at all. Furthermore, an assumption of some kind is necessary since the Miscellaneous category represents the single largest share of expenditures for all representative households: low income households spend 33.5%, medium income households spend 41.4%, and high income households spend 48.2% of their income on the category. I note that this category includes many tradeable goods with global supply chains such as electronics and clothing. This implies that estimates of global GDP effects may be more relevant for this expenditure category than local effects.

To form the estimated effect, I take baseline estimates from the papers above, generally reported in terms of GDP loss in the year 2100, and scale them to 2050. For example, in their baseline estimates, Kahn et al. (2021) report GDP loss of 7.22% between 2015 and

2100, implying a loss of 3.04% by 2050. The result of this procedure is an estimated price increase of 10.52%.

## 5 Results

Table 4 reports the results of applying the price changes described above to the representative households under the Almost Ideal framework. In short, households spend more to receive less: the low-income household increases spending by almost 6%, with a 1% decrease in the quantity index. The high-income household increases spending by roughly 5%, with a 4% decrease in their quantity index. All households reduce their savings rate, with larger decreases in lower-income households (who already have negative savings rates in the baseline data). The patterns of changes in spending shares across income levels is relatively consistent: all households increase the relative spending share for shelter by greater than one percentage point, due in part to the relatively small increase in prices for that sector relative to the other sectors I consider. This increase comes from decreases in utilities, transport, healthcare, and miscellaneous; the spending share for food stays nearly constant. The compensating variation ranges from roughly $5,000 for low income households to $16,000 for high income households.

Since the AI specification detailed in Section 3 does not feature differences in own- and cross-price elasticities across incomes, the differences in these changes across households are driven by the distribution of spending across categories. As a fraction of income, lower-income households spend more on shelter, food, and utilities, while higher-income households spend more on transportation and the catch-all "miscellaneous" category.

To put these numbers into context, the change in savings rate is of a similar magnitude to the change in savings rates experienced during the Great Recession (Dynan, 2009; Mody et al., 2012) and during the first wave of the COVID-19 pandemic (Cox et al., 2020), though with the opposite sign (i.e. savings increased during these events and I forecast decreased savings due to climate change). Similarly, the level of compensating variation required for low income households is similar to the average SNAP benefit of $3,984 per household in fiscal year 2023 (Monkovic and Ward, 2025).

**Table 4:** Estimated Change in Expenditure Patterns, 2023-2050

| | Low Income | | Medium Income | | High Income | |
|---|---|---|---|---|---|---|
| *Spending shares by sector (%)* | Baseline | After | Baseline | After | Baseline | After |
| Food | 9.57 | 9.64 | 7.87 | 7.98 | 6.13 | 6.21 |
| Shelter | 22.88 | 25.8 | 18.7 | 21.2 | 18.1 | 20.6 |
| Utilities | 8.15 | 7.93 | 5.97 | 5.85 | 4.27 | 4.18 |
| Transport | 15.96 | 14.4 | 18.1 | 16.5 | 16.8 | 15.3 |
| Healthcare | 9.90 | 9.03 | 7.97 | 7.33 | 6.42 | 5.89 |
| Miscellaneous | 33.5 | 33.1 | 41.4 | 41.2 | 48.2 | 47.9 |
| *Overall changes (%)* | | | | | | |
| Spending | 5.89 | | 5.23 | | 5.38 | |
| Savings rate | -7.10 | | -4.40 | | -3.82 | |
| Share-weighted quantity index | -0.99 | | -3.70 | | -3.98 | |
| Compensating variation ($) | 5,325 | | 9,525 | | 15,819 | |

Notes: Households constructed from the 2023 Consumer Expenditure Survey. 'Baseline' refers to the 2023 data. 'After' refers to the 2040-2050 decade. Compensating variation is annual and reported in 2023 dollars.

While substantial assumptions are required for each of the categories in the demand system, perhaps the most questionable is the assumption for the "Miscellaneous" category. This may be especially concerning since this category is the single largest category for each household. As a sensitivity test, I recalculate the results assuming that the price in this category is invariant to climate change (i.e. $\Delta P = 0$). Under this assumption, low income households increase spending by 6.76%, medium income households increase spending by 6.22%, and high income households increase spending by 6.55%.

## 6 Conclusion

Though scientists, policymakers, and public figures have worked for years to educate the broader public about the progression and effects of climate change, much resistance to the concept still exists with meaningful influence on the political process in the United States and elsewhere (Leiserowitz et al., 2019, 2025). Helping households understand the impact of climate change on their own financial picture remains one of the most effective communication tools (Eisenack et al., 2014; Moser, 2014). However, most efforts to predict the effects of climate change on future economic outcomes conduct analyses that are aggregated far beyond the household level, or focus on only one part of a household's budget.

In this paper, I have outlined an approach to compute estimates of the impact of climate change on household budgets in Oregon that synthesizes a flexible model of demand for categories of goods and services with estimates of sector-level price changes extrapolated from the literature. The results suggest that, after taking into account substitution effects, climate change will increase prices and total spending, while reducing quantities and household savings. In other words: climate change will substantially affect the quality of life across income groups. The welfare loss, defined as the annual compensating variation required to maintain baseline utility, is \$5,325 for low-income households (13.1% of real income), \$9,525 for medium-income households (9.1% of real income), and \$15,819 for for high-income households (7.5% of real income).

These results can provide a baseline for considering the costs and benefits of investments in adaptation strategies and other policy interventions. For example, public investments that would completely eliminate price changes could be worth thousands of dollars per household, though at the cost of increased tax burdens. Similarly, as my estimates suggest a strain on household finances comparable to that experienced during the Great Recession, similar-scale policy responses may be necessary.

That said, I wish to highlight the breadth and depth of assumptions required to produce these estimates. These estimates rely on four distinct layers of assumptions: (1) that sectoral price forecasts from diverse sources and scenarios are compatible, (2) that 100% of any cost changes will be passed-through to consumers, (3) that elasticities estimated from historical price variation apply to climate-driven changes, and (4) that cross-category price interactions can be ignored. Each assumption is questionable; jointly, they strain credulity.

There is also a question of external validity with respect to the estimates of household demand. Households may respond differently to broad-spectrum price increases than they do to price shocks to individual goods. Furthermore, this analysis holds real income constant. If real output broadly decreases (relative to a baseline of no climate change), income will likely decrease as well.

What would it take to produce more plausible estimates? Fundamentally, climate change impacts households by affecting the production functions of goods and services in such a way that current levels of output will be unachievable with current real spending on inputs. These adverse production function effects will be passed-through to households through the output channel as mediated by intra- and inter-sectoral competition, and through input channels as the marginal product of labor changes as mediated through the competitive structure of labor markets. Those price and income changes will then affect household behavior and welfare as mediated by each household's patterns of labor and consumption decisions. Thus, any foundational work seeking to improve our understanding of these issues may potentially improve our understanding of the economic effects of climate change.

There is also no consensus about the way to model each of these processes in the abstract sense. In the present analysis I have taken a partial equilibrium approach to allow for greater granularity in consumption decisions. It may be more appropriate to use a model of general equilibrium at a higher level of consumption abstraction to focus instead on the interplay of labor and output markets. Ultimately, reasonable estimates of the impacts of climate change on household budgets will likely be produced through many sets of models, assumptions, and data inputs, and meta-synthesis work will be necessary to produce reasonable ranges of outcomes in the same way that various intergovernmental agencies have produced a range of future scenarios for the physical effects of climate change as outputs of meta-analyses of computational models of atmospheric processes.

Ultimately I present these estimates to inspire additional research that can be used to fuel such predictions. Climate change presents a collective action problem on a massive scale across geographies, populations, and time periods. Tackling that problem requires making the consequences tangible to those outside of the scientific community. Policymakers should use household-level measures of impacts alongside aggregate GDP predictions when communicating with constituents.

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