**APPENDIX A: MODEL OF CONSUMER CHOICE AND MARKET RESPONSE**

**A.1 Model of Consumer Choice**

This appendix provides a more complete derivation of the change in willingness to pay represented by Equation 3 in the main text. First, we assume a consumer lives for two periods and has a time-invariant utility function over two goods: a health-related good (*Q*) and a composite good (*Y*). This consumer’s lifetime utility function is defined as follows:

 , (A.1)

where

* = the quantity of *Q* consumed in period *i*
* = the quantity of *Y* consumed in period *i*
* = the discount rate

This person’s consumption in each period is constrained by her income (for ease of exposition we assume no savings between periods). In period 1, she enjoys a baseline level of health and faces the following budget constraint:

 , (A.2)

where

* = the consumer’s base income
* = the price of *Q* in period 1
* = the quantity of *Q* purchased in period 1
* = the quantity of *Y* purchased in period 1 (whose price is unity).

In period 2, there is some probability that the consumer’s income will change based on her health status. In the baseline health scenario, her health remains unchanged from period 1, and she will earn the same income as before and face the same budget constraint as in period 1:[[1]](#footnote-2)

 , (A.3)

where

* = the consumer’s base income
* = the price of *Q* in period 2
* = the quantity of *Q* purchased in period 2 if the consumer has baseline health status
* = the quantity of *Y* purchased in period 2 if the consumer has baseline health status.

By contrast, if her health improves in the alternative health scenario (e.g., because her body mass index [BMI] decreases or she is cured of a preexisting disease), her income will increase. This outcome may occur because improvements in health could lead to greater productivity. If her health deteriorates in the alternative health scenario (e.g., because her BMI increases or she contracts a new disease), her income will decrease. This outcome may occur because deteriorating health could lead to lower productivity. In either case, she will face the following budget constraint:

 , (A.4)

where

* = the consumer’s base income
* *H* = the monetary cost or benefit associated with the alternative health status (where *H* < 0 denotes a poorer health status that results in less income)
* = the price of *Q* in period 2
* = the quantity of *Q* consumed in period 2 if the consumer has an alternative health status
* = the quantity of *Y* consumed in period 2 if the consumer has an alternative health status.

Let be the consumer’s belief about the cumulative probability of a change in health status next period, which is a function of how much *Q* is consumed in period 1. Similarly, let the probability of the consumer facing her baseline status be . Therefore, the expected utility experienced in period 2 is described by the following:

 . (A.5)

Given the assumptions above, the consumer’s problem is to maximize her lifetime expected utility () by solving the following constrained maximization problem:

|  |  |
| --- | --- |
|  | (A.6) |
| . |

To make this problem tractable, we assume that the consumer’s preferences are quasi-linear and that their time-invariant utility function can be expressed as follows:

 . (A.7)

The consumer’s constrained optimization problem can now be solved as follows. First, substitute Eq. A.7 into the lifetime expected utility function. Next, use Equations. A.2, A.3, and A.4 to substitute for , , and .

The first order condition for *q1* is now the following:

 . (A.8)

Rearranging this equation (and assuming that income is sufficient so that ), yields the following inverse demand function for Z in period 1:

 , (A.9)

where is the marginal utility of *q1*, measures how much the probability of attaining

the alternative health state in period 2 changes as a person consumes more of good *Q* in period 1, and is the discounted value of the monetary benefit (or cost, if *H*<0) associated with the alternative health status. The inverse demand function in Eq. A.9 tells us the marginal willingness to pay (WTP) for *Q* in period 1 such that . In other words, it measures, at any quantity of *q1*, how many dollars the consumer is willing to give up for a little bit more of *q1*.

 At this point, we can directly connect our consumer response model to our Bayesian learning model through the structure we place on . Specifically, assume that π is defined by the following function:

 if (A.10)

Where is the consumer’s belief about the lifetime probability of a change in health status next period and be the quantity of *Q* consumed this period. The parameter can take any value between 0 and 1 and represents how much the consumer believes her risk of a change in health status will increase for every unit of *Q* she consumes. As discussed in the main body of the manuscript, we allow the consumer to hold uncertainty about the true value of and represent the consumer’s risk beliefs with a normal probability distribution, . The mean, , is the consumer’s estimate of the health risk associated with consuming product *Q*. The variance, , captures the uncertainty of that estimate.

Under this assumption, is equal to . Making this substitution yields:

 . (A.11)

If risk beliefs change, we would expect a change in the WTP per unit equal to the change in the perceived probability of facing a change in health status multiplied by the value of the change in health, shown as:

 (A.12)

where is the perceived change in the marginal risk of consuming the health-related good, is the monetary cost or benefit associated with the alternative health status, and is the discount factor. When , this denotes a poorer health status. Now, we can see that the extent to which new health information changes consumer demand will depend on the extent to which the information treatment changes .

Dividing Equation A.12 by the price of the product prior to the release of the new health information, P1, yields the following equation for a consumer’s percent change in WTP:

 (A.12)

**A.2 Model of Market Response**

We use an equilibrium displacement model to estimate how a shift in a product’s demand will lead the market to adjust from an initial equilibrium price and quantity (*Ppre* and *Qpre*) to a new equilibrium price and quantity after the new health information is released (*Ppost* and *Qpost*).

The equilibrium displacement model starts with a standard set of economic structural equations of supply and demand (Wohlgenant, 2011).

Structural equations:

 (A.13)

 (A.14)

 , (A.15)

where

* = relative change in demand (measured as percentage change)
* = relative change in supply (measured as percentage change)
* = relative change in market equilibrium price (measured as percentage change)
* = own-price elasticity of demand
* = own-price elasticity of supply
* = relative exogenous change in demand (measured as percentage change, where a negative value denotes a vertical, downward shift in demand)

The new equilibrium price and quantity are found by simultaneously solving this system of equations so that and are functions of exogenous variables: , , and . Equilibrium and are expressed as follows:

 (A.16)

 . (A.17)

Next, these expressions for the relative changes in equilibrium price and quantity can be combined with data on the initial equilibrium price and quantity to calculate the new equilibrium price and quantity as follows:

 (A.18)

 . (A.19)

1. Note that allowing income to also change for non-health reasons between period 1 and period 2 would not change the results of the model. Therefore, for ease of exposition, we assume income does not change between the two periods for reasons other than health. [↑](#footnote-ref-2)