

What is the contingent valuation method, CVM?

Cvmbasic.doc Nov 1, 2018 and cvmbasic.pdf

The purpose of the notes is to prepare to you answer the CVM questions on the third set of review questions.

Before we begin, consider ads for lost pets. People are advertising that their WTP for the return of the pet is at least the \$ amount stated on the ad. (Phil's Dog Winston)

CVM is a nonmarket-valuation method that is used to value specific changes from the status quo.

CVM estimates total value (use and nonuse)

Environmental economists often use it to value environmental policies or damages; e.g. determining wtp to assure that there is not another large oil spill of the Exxon Valdez or BP type.

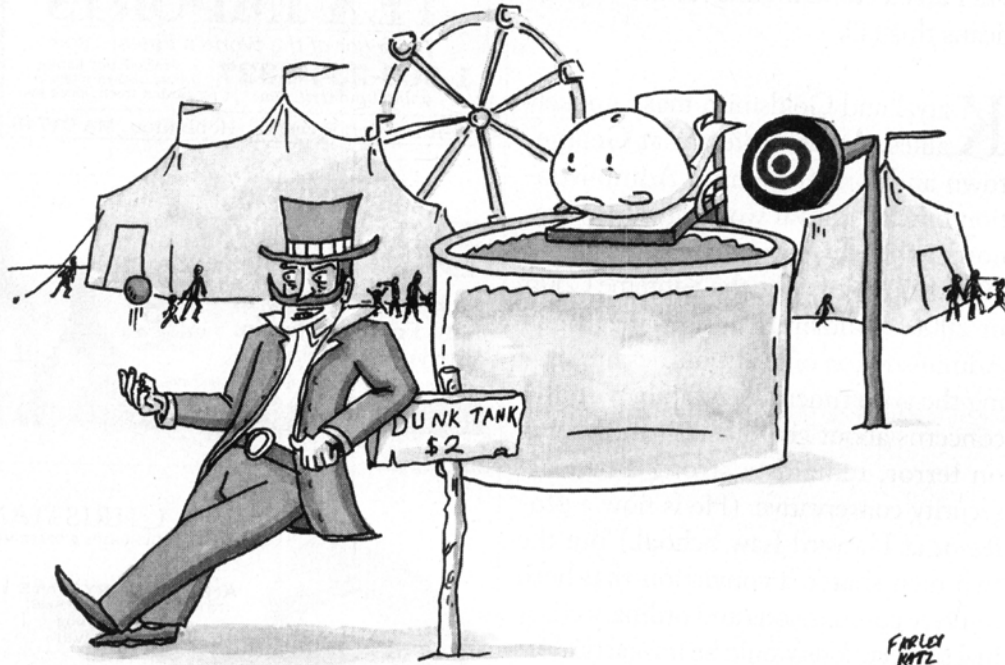
How much is an individual damaged by a polluted river, or a polluted Gulf of Mexico?

CVM is a stated-preference technique, as in the individual "states" his preference.¹

Specifically, in CVM individuals are asked about the status quo versus some alternative state of the world, and information is elicited about how the individual feels about the alternative relative to the status quo, and their WTP, if anything, to obtain the alternative.

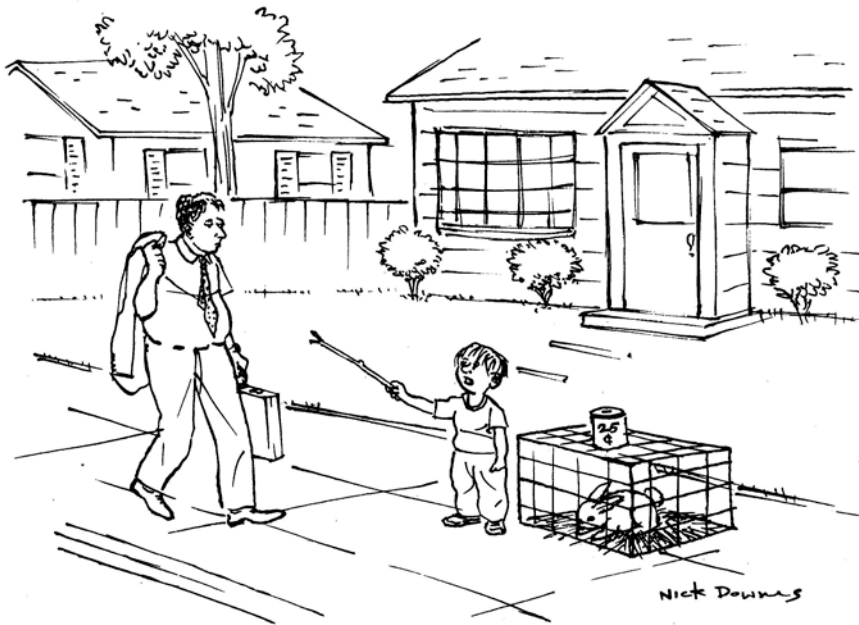
Note that while the next cartoons are sick, as I prefer, they, strictly speaking, are not examples of CVM because they are not "contingent"/hypothetical. The word "contingent" in the expression CVM means hypothetical.

¹ In contrast to the revealed preference techniques like travel cost and hedonics where value is estimated based on what people do (their behavior) rather than what they say. Contrast observing me buying Wanda Sue expensive jewelry and fulfilling her every wish, with my statement that "I love Wanda Sue."
Cvmbasics.doc and .pdf: Morey Nov 1, 2018



FARLEY
KOTZ

"Step right up and save a baby whale's life."



Nick Downes

"Poke my bunny with a stick, sir?"

There are many different types of CVM question formats. For example, the following are different formats for soliciting information about one's wtp to introduce wolves back into Colorado.

These different types of CVM questions would each be preceded with background materials and details (you would only ask one of these questions)

- “What is the max you would pay to create four self-sustaining wolf packs in four remote areas of Colorado?” This type of question is called “open-ended” CVM, “open-ended” because the respondent is open to say any amount that they want.
- “Creating four self-sustaining wolf packs in four remote areas of Colorado will increase your state taxes by \$10 a year for five years. Would you vote for such a proposal?” This is a “referendum CVM” question—\$ amount asked varies across respondents.²
- “On the following payment card (a card with a bunch of different \$ amounts) circle the largest amount you would be willing to pay to create four self-sustaining wolf packs in four remote areas of Colorado.” This is a “payment-card” question.
- Bidding: I ask, “Would you pay \$X to create four self-sustaining wolf packs in four remote areas of Colorado?” If you say “yes”, I can ask about $\$(X+Y)$. If you say yes to $\$(X+Y)$, then I ask a larger amount, etc. Questions stop when you say no. Or if you say “no” to \$X, then I ask about a smaller amount. Can also play this game starting with a large amount and work down. This is called a double-bounded referendum CVM question.

A Referendum CVM question is a single discrete-choice question where one of the alternatives is the status quo.

A discrete choice because you must choose between a finite number of alternative: two.

² Here in Colorado, we often have referendum on the ballot. Ballot referendums are binding (non-contingent) in the sense that if a certain percentage votes for the referendum, it becomes policy (law). Cvmbasics.doc and .pdf: Morey Nov 1, 2018

In theory, what does each of these question types tell the researcher about the individual's wtp to reintroduce wolves in Colorado? In order:

Open ended: The individual's wtp

Referendum: Whether the individual's wtp is greater or less than the stated amount

Bidding card: A range on the individual's wtp

Referendum with follow-up: A range

CVM questions, like all survey questions, are difficult to ask well.

Before the CVM question is asked, individuals are presented with background and explanatory material, and often asked other questions.

A few of the worries about the CVM

- Individuals do not necessarily have a strong incentive to think seriously about their answer because they will not be penalized for answering foolishly.³
- Individuals who take such questions seriously might have an incentive to lie (distort their answer—the bias can go in either direction)

Not taking the question seriously adds noise to the data, not bias

Lying adds bias – bias is a bigger concern than noise.

Why might someone vote yes to a referendum CVM question even though their WTP is less than the bid amount?

Why might someone vote no to a referendum CVM question even though their WTP is greater than the bid amount?

Note that there is also noise and potential bias in RP data.

We do not always buy the utility-maximizing bundle—we make mistakes, some costly. There are many issues, lack of information, uncertainty, emotional state, etc.⁴

It is three in the morning, I have drunk a large quantity of wine, am now eating chips and watching reruns of [Gilligan's Island](#) on TBS. A week later UPS dumps a Vegematic machine and a [Bow Flex](#) workout machine on my front porch. My credit card gets docked \$49.99 a month for 24 months. See the last footnote.

³ Note the market punishes the rash individual who pays more than their WTP: the purchase decreases his utility. Some economists worry a lot that CVM does not give the respondent a strong incentive to answer correctly. Others worry less about this. Since the payment is hypothetical there is not a strong incentive to strategically state an amount less than WTP.

⁴ Simple economic consumer theory assumes that individuals always behave rationally, but there is a lot of evidence that this is not the case.

In terms of the different CVM methods, referendum CVM has the highest standing amongst experts and the courts.

- The question elicits value as it is elicited in the market place. In the marketplace one does not have to determine one's exact WTP, only whether it is greater or less than the stated amount.
- Referendum CVM is identical to a ballot referendum, except the question is hypothetical.
- It was endorsed by a NOAA "blue ribbon" panel of Nobel Laureates in economics for use in legal cases.
- Different individuals are presented with different dollar amounts (the researcher sees what proportion of respondents say yes to each amount – proportion of yeses on the vertical axis, bid amounts on the horizontal axis)

Draw an example

- Sometimes the CVM question is double bounded, or one and "one-half bounds," or whatever.⁵

⁵ Doubled bounded means that if you answer yes (no) to \$x, you are then asked about a higher (lower) amount. I forget what one-and-a-half bounds means.
Cvmbasics.doc and .pdf: Morey Nov 1, 2018

Turning CVM data in estimates of WTP

- Open-ended CVM data: For the policy one has an estimate of each individual's WTP for the policy.

Some of these could be zero or, possibly, negative. One obtains an estimate of average WTP by taking the average of the estimates. It is of interest to compare the average WTP to the median WTP—they often are quite different. The range is also of interest.

If there are negative WTP, why is it important to include these negative WTPs in the calculation of average WTP?⁶

Using open-ended CVM data does not require that one assume identical preferences across individuals with the same characteristics

One might regress the stated WTP on characteristics of the respondents such as income, gender, age, etc.

For example, young, poor black males who live in the ghettos of Washington, D.C. probably have a lower WTP for preserving monuments to old, dead, white dudes than do old, rich white women who belong the Daughters of the American Revolution (<http://www.dar.org/>)

For example, one might estimate the linear regression

$$Wtp_i = a + b(\text{income}_i) + c(\text{gender}_i) + d(\text{race}_i) + e_i$$

Where e is a random term, and $a, b, c,$ and d are the parameters to be estimated.

One hopes one has a representative sample for the population of interest (this hope holds no matter what sort of CVM data one collects).

⁶ A negative WTP indicates the policy makes the individual worse off, and is, in absolute terms, the individual's WTA the policy.

- Referendum CVM: For each individual one has data on whether the individual voted yes or no to the policy with a tax increase of \$X, where \$X varies across respondents (e.g. \$1, \$5, \$10, etc.).

Converting this type of data into estimates of WTP is more difficult than with open-ended CVM data because for each individual one only knows whether that individual's WTP is greater than or less than the stated amount. For example, if the individual said they would vote for the change if it increased their taxes by \$5, all the researcher knows is that this individual's WTP is equal to or greater than \$5.

One simple estimate of WTP from referendum CVM data is the *Turnbull estimator*; it can provide a lower-bound estimate of average WTP for the sample with few restrictive assumptions about preferences.

I'll demonstrate the Turnbull estimator with a few examples. At each bid amount determine the proportion of people who were offered that amount and said yes.

Let's start simple by assuming that everyone was presented with a bid amount of \$50 - take it or leave it at \$50. Assume 30% said yes. And that we **somehow know**⁷ that wtp is bounded from below by zero and from above by \$200.

What can we determine about WTP? Can we put upper and lower limits (bounds) on it? Yes. We already know its between zero and \$200, but can we restrict it more?

⁷ God told us?

What can be deduced? Thirty percent of the sample has a WTP of at least \$50, and 70% has a WTP of at least zero.

So, $.70(\$0) + .3(\$50) = \$15$ is a lower-bound on average WTP based on this data set.

The conservative assumption that people who said no to \$50 have a WTP of zero. And that those who say yes to \$50 only have a WTP of \$50.

What else can we deduce from these simple referendum CVM results?

Seventy percent of the sample has a maximum WTP of \$49.99 (they said no to \$50), and thirty percent has a maximum WTP of \$200.

So, $.7(\$49.99) + .3(\$200) = \$95$ is an upper-bound on average WTP;

WTP cannot be larger than this amount.

Based on the one bid referendum CVM and our assumption that WTP is bounded by zero and \$200, we estimate that average wtp is between \$15 and \$95.

A big range, but we don't have a lot of data. If you were suing for damages, you would be comfortable in defending average damages of \$15 and be unable to defend average damages of more than \$95.

Now consider a more complicated experiment: bid amounts at \$10, \$50, and \$100. Assume 50% of the sample who saw \$10 said yes, 30% of those who saw \$50 said yes, and 10% of those who saw \$100 said yes. Assume that WTP is never negative and never more than \$200.

A lot more information about WTP is collected when there are multiple bid amounts (there is three subsamples, each sees a different dollar amount, have the percent yes for each subsample)

What can be deduced? Starting with the end points, 50% of the sample has a WTP of **at least zero**, and 10% have a WTP of at least \$100.

wtp greater than \$10 = 50%, so wtp between 0 and \$10 is also 50%

wtp between \$100-\$200 = 10%, so 90% are less than \$100

In addition, 20% have a wtp somewhere between \$10 and \$50. Why? Why because 50% yes to \$10 but only 30% said yes to \$50

And 20% have a wtp between \$50 and \$100. Why? Because 30% said yes to \$50 but only 10% said yes to \$100.

So, 50% between zero and \$10
 20% between \$10 and \$50
 20% between \$50 and \$100
 10% between \$100 and \$200

So a lower-bound estimate of average WTP is $.5(0)+.2(\$10)+.2(\$50)+.1(\$100)=\22

Including in the data bid amounts at \$10 and \$100 changed the lower-bound estimate of WTP from \$15 to \$22.

What is the upper-bound estimate of average WTP given this additional data? What do we know?

10% said yes to \$100, so for 10% of the sample maximum wtp is \$200.

50% of the sample said no to \$10, so for 50% of the sample max wtp is \$9.99.

How about for the other 40%? 50% of the sample said no to \$10 and 70% said no to \$50, so 20% of the sample are in the \$10 to \$49.99 range, so have a max wtp of \$49.99.

70% of the sample said no to \$50 and 90% said no to \$100, so 20% of the sample have a maximum wtp of \$99.99.

So $.5(\$9.99)+.2(\$49.99)+.2(\$99.99)+.1(\$200)=$ approx \$35, so \$35 is an upper-bound estimate of average WTP from this data set.

Having the data at the bid amounts of \$50 and \$100, brought the upper-bound estimate of average wtp down from \$95 to \$35. With the expanded data set estimated average WTP is between \$22 and \$35.

The Turnbull estimator (upper or lower bound) is called a non-parametric estimator because it does not require one to make a lot of restrictive assumptions about the respondents' preferences.⁸

Many of the other methods of deriving WTP estimates from referendum data require many restrictive assumptions.

⁸ Note that the lower-bound estimate depends critically on the assumption that no one has a negative wtp. And the upper-bound estimate depends critically on the assumption that no one has a wtp greater than \$200. These are strong and restrictive assumptions.
Cvmbasics.doc and .pdf: Morey Nov 1, 2018

- Payment card and bidding method: In these cases, as in the case of referendum, one has a range on WTP for each individual, only the range is smaller than in the referendum case.

The range is smaller because there is more data.

The following is a CVM study done by me and two students as a class project for the graduate environment seminar,

[Using Contingent Valuation to Estimate a Neighborhood's Willingness to Pay to Preserve Undeveloped Urban Land](#)

William S. Breffle, Edward R. Morey, and Tymon S. Lodder

Urban Studies, Vol. 35, No. 4, 715-72, February 1998

There might some questions on the review sheet about the “Cunningham study”. This paper describes the Cunningham study. And there might be a quiz seeing what you learned by reading the article.

Depending on how quickly we get through the basics of non-market valuation we might look at a specific study.

Make sure you can now answer most of the CVM review questions and the CVM review questions on old exams. You can ask me.