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Five Methods for Measuring Unobserved Events: A Case Study of Federal Law Enforcement

By John Whitley

Law enforcement can face tough measurement challenges, but the fields of statistics and econometrics have developed a framework for dealing with them and it is useful to begin with a brief overview of that framework. All violations of a federal law can be thought of as elements of a prospective data population. The scope of the population can be defined in various ways—e.g., immigrants illegally entering the United States in a calendar year, or the illegal drugs smuggled across the southwest land border between the United States and Mexico. To effectively manage their operations, federal law enforcement officials need insight into these unobserved violations; i.e., they need to know the properties or parameters of this population of data, such as its size and distribution.

Five methods that can assist government performance analysts in estimating basic information on unobserved events are introduced and described here.

Method One

Administrative Records: Once a performance manager has identified the outcomes that need to be measured and is beginning the task of developing a measurement strategy, the first action is to identify all relevant data currently captured by the agency or by others. In the best-case scenario, the performance manager may discover relevant data at a lower level in the organization (e.g., at the field offices) or in another organization (e.g., in a survey conducted by the Census Bureau that asks a pertinent question).

Or it could be that estimation of the outcome is possible, but that multiple sources of data have to be combined and those sources are spread across organizations. For example, Immigration and Customs Enforcement is responsible for law enforcement concerning individuals who enter the United States on visas, but violate the visa by overstaying the required departure date. The rate of visa overstay, however, is unobservable to federal law enforcement. The number of visas issued and their required departure dates are known, but who actually departs and when is not. Everyone leaving

Example of Using Administrative Records Recidivism Analysis

The U.S. Border Patrol (USBP), within the DHS Customs and Border Protection, is responsible for controlling the U.S. land border with Mexico between the Ports of Entry (POEs). USBP maintains a detailed database called ENFORCE on all apprehensions of illegal border-crossers. When illegal border-crossers from Mexico are apprehended and returned to Mexico, many try again within a relatively short period of time. In fact, if all who were returned attempted to cross again, the fraction apprehended a subsequent time would constitute an estimate of the apprehension rate. With an estimated apprehension rate in hand, it is then possible to estimate the flow of illegal border-crossers.

A challenge with this approach is that every individual who is apprehended and returned does not attempt a subsequent crossing—the first apprehension acts as a deterrence (referred to as at-the-border deterrence). This means that recidivism analysis by itself does not solve measurement challenges, but it can provide an important part of the solution in situations where it is appropriate. If it can be combined with estimates from other sources on the deterrence effect of apprehensions, it can be used to create an estimate of apprehension rate and, subsequently, the rate of illegal immigration.

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the United States by commercial air or maritime transport is known because they are identified in passenger manifest documents maintained by the transportation companies. Thus, a major portion of the performance measure can be estimated by combining data from government visa records with commercial transportation passenger manifests.

Example of Using Surveys National Crime Victimization Survey (NCVS)

Many state and local crimes leave aggrieved victims and physical evidence and are more likely to be reported to law enforcement officials than some federal crimes are. But this reporting is still not perfect, and the records of these reported crimes may not represent the full extent of the crime committed. The NCVS is one method law enforcement officials use to understand and measure potential undercounting.

According to its official website, the NCVS surveys a nationally representative sample of about 40,000 households on criminal victimization in the United States. Each household is interviewed twice during the year. The data are then used to estimate the likelihood of victimization by rape, sexual assault, robbery, assault, theft, household burglary, and motor vehicle theft for the population as a whole as well as for segments of the population such as women, the elderly, members of various racial groups, city dwellers, or other groups.

More information on the NCVS is available from the Department of Justice at http://bjs.ojp.usdoj.gov/ index.cfm?ty=dcdetail&iid=245.

Method Two

Surveys: Surveys are a commonly used data collection method in policy and social science research. Surveys involve asking a set of questions to a sample population. They can be conducted by telephone or mail, online, or in person. The goal is to obtain a sample of sufficient quality, e.g., size and representation, to enable inferences to be drawn about the population from analysis of the data. Surveys may be conducted on a regular, recurring basis to create estimates through time or can be conducted on a one-time basis to answer specific questions at a point in time.

There are numerous surveys already being conducted by the government and private organizations that provide valuable information on federal law enforcement issues. The U.S. Bureau of the Census and its many supporting surveys provide some of the most comprehensive data about the United States. Other federal agencies conduct a wide range of surveys that include specific emphasis on law enforcement issues, such as the National Crime Victimization Survey (NCVS) discussed in the National Crime Victimization Survey box. Surveys are also conducted by academic researchers, think tanks, and private companies. In some situations, there may already be a recurring survey conducted that is close to, but not exactly, what the performance manager needs; a cost-effective way to get started is to partner with the organization conducting the existing survey to expand it in a way that would be useful for the law enforcement performance measurement.

Method Three

Inspections, Investigations, and Audits: Criminal or administrative investigations offer another way to systematically collect an accurate data sample. The important point about using investigations in the context of measuring unobserved events is that the investigations must be in some way random. In typical law enforcement operations, proactive

Example of Using Audits
National Research Program

The Internal Revenue Service (IRS) within the Department of the Treasury is the nation's tax collection agency and administers the Internal Revenue Code. The tax gap is the IRS's measure of tax liability that is not paid on time. The IRS National Research Program (NRP) measures the tax gap using randomized audits.

Most IRS tax audits are targeted to those tax returns for which there is suspicion of non-compliance. These audits cannot be used to develop an estimate of overall compliance because they are not a representative sample of all tax returns. The NRP, therefore, conducts audits on a random set of tax returns to develop an unbiased estimate.

The NRP originally drew samples every few years of about 45,000 individuals. In 2007, it switched to an annual sampling of 13,000 individuals. This allows the IRS to make more frequent estimates and more accurately monitor trends. The majority of individuals selected will have their tax returns confirmed through in-person audits with an IRS examiner. The IRS will also use matching and third-party data to confirm the accuracy of the tax returns.

Example of Using Field Experiments
Randomized Secondary Screening

The Office of Field Operations within U.S. Customs and Border Protection (CBP) is responsible for screening all individuals entering the United States at Ports of Entry. With 340 million individuals entering the United States at these ports per year, this is a high-volume process. All individuals are subjected to a primary screening procedure to ensure compliance with U.S. entry law.

To empirically estimate the failure rate of the primary screening process, CBP randomly selects a sample of the entrants at both air and land ports to conduct a more thorough examination for major violations. Major violations involve serious criminal activity, such as possession of narcotics, smuggling of prohibited products, human smuggling, weapons possession, fraudulent U.S. documents, and other offenses serious enough to result in arrest. For the air domain, passengers are selected in a random sample that totals 12,000 passengers annually (1,000 passengers per month) at each of the 19 largest international airports. Similarly, for the land domain, passengers are selected in a random sample that totals 12,000 passengers annually (1,000 passengers per month) at each of the 25 largest land border ports. These sample sizes were selected to obtain an overall 95 percent confidence level in the estimates.

investigations are prioritized to follow the most important clues or those that are most likely to lead to a major arrest or disruption of crime. Investigations prioritized in this manner may not provide statistically valid estimates of the underlying level of criminal activity. Conducting investigations on a more random sample of potential illegal activity represents a major cultural shift for law enforcement operations, but limited and systematic use of them can be a powerful way to collect information about the outcomes the law enforcement organization is trying to effect. See the National Research Program text box for an example of this method.

Method Four

Experimental Methods: Another method involves actually adding or modifying law enforcement activities in the field in ways that may facilitate estimation of the crime rate. In controlled environments like Ports of Entry or airport security screening, this could involve selecting a randomized subset of individuals who pass the primary screen for a secondary, more rigorous screen. The rate at which violations are identified in the secondary screen can be used to infer the failure rate of the primary screen. The Randomized Secondary Screening text box describes how CBP conducts these randomized secondary inspections at Ports of Entry. This method is not restricted to physical screening—application processing and other forms of information-based screening can also have randomized secondary evaluations conducted to evaluate the accuracy of the primary screening process.

Example of Using Technical Measurement Measuring Drug Production

A major area of federal law enforcement is combating the smuggling of illegal drugs into and within the United States. Although some drugs have significant domestic production, e.g., methamphetamine, many drugs are predominantly produced internationally and smuggled into the United States, e.g., cocaine. Identifying the flow of illegal drugs into the United States is an important measure, but unobserved to federal law enforcement officials.

The U.S. Government and the United Nations both produce systematic estimates of drug flows and these estimates start with technical measurement by satellite and aerial imagery. For cocaine, the U.S. estimates are produced by the Inter-Agency Assessment of Cocaine Movement (IACM). These estimates use Intelligence Community (IC) imagery of coca-producing countries to estimate the total level of cultivation. Subsequent analyses include likely harvest yields, refined product yields, distribution destinations (i.e., how much goes to U.S. markets versus markets in other countries), and flow across individual vectors or pathways (e.g., overland through Mexico versus maritime transit through the Caribbean). The final estimates are thus produced by combining many of the different methods described in this report, but the estimation starts with technical collection by satellite and other imagery.

Example of Using Technical Measurement Counterfeit Detection

The original mission of the U.S. Secret Service, now within DHS, was to investigate counterfeiting of U.S. currency. Although presidential protection was later added and is now what the Secret Service may be best known for, the Secret Service remains the primary law enforcement organization on counterfeiting. Working with the Federal Reserve Board (FRB), the Secret Service is able to estimate the level of counterfeit currency in circulation in part through technical measurement.

Method Five

Technical Measurement: Although there are many more methods that can be used, the final method described here is technical data collection. Well-known examples at the state and local level include red-light and speeding cameras and, more recently, gunfire detectors in some major cities. Examples at the federal level include the use of sensors, radars, and unmanned aerial vehicles to detect illegal immigrants crossing the border, and radiation detectors and X-ray screening of containerized cargo entering the United States. See the Measuring Drug Production and Counterfeit Detection text boxes for examples of this method.

TO LEARN MORE

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The report can be obtained:

- **In .pdf (Acrobat) format at the Center website, www.businessofgovernment.org**
- **By e-mailing the Center at businessofgovernment@us.ibm.com**
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