Street cred. A researcher gathers data on household income in a rural area of Shandong Province.

SOCIAL SCIENCE

The Numbers Game

In China, statistics have long been skewed by their use in rewarding performance; social scientists say they are beginning to remove those distortions

SHANGHAI, CHINA—When economist Gan Li set out in 2009 to survey thousands of Chinese households on income and assets, he had a modest goal: Expand the nation's scant information about its economic life. No detailed household survey data were available that could offer a fair picture of the situation nationwide. Everything from household wealth to the percentage of Chinese owning multiple homes was unknown. China had—and still has—"very little knowledge about its baseline," says Gan, who splits his time between Texas A&M University, College Station, and Southwestern University of Finance and Economics in Chengdu. His project, called the China Household Finance Survey, got little direct support from China's National Bureau of Statistics (NBS), effectively the only source of household income information then, Gan says. But the bureau didn't try to block his work.

Gan's ability to quietly research vanished, however, when he and colleagues used their data to estimate China's Gini coefficient, a common index of income inequality. It runs on a scale from 0 to 1, with 1 being severe inequality. Accepted wisdom held that a Gini coefficient above 0.4 yields societal instability, and Gan had assumed that anything above 0.6 would be "maybe revolutionary." NBS had last released a Gini value in 2000, when it was 0.41. In findings released last December, Gan and colleagues calculated it at 0.61.

Income Inequality as Rated on the Gini Index
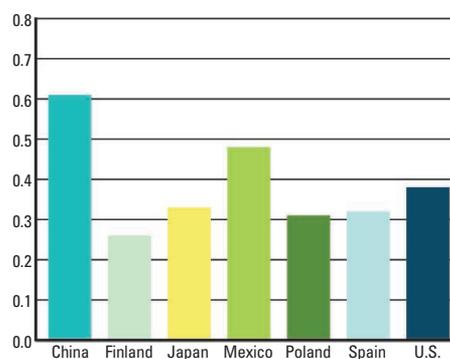
High on disparity. A 2012 study placed China among the nations with the largest income differences.

NBS officials countered Gan's research by pointing to his small sample size and the fact that he employed novice student interviewers. (Gan says that his sample has an error of only 1%, and the surveyors underwent 56 hours of training.) A mere month after Gan and colleagues published their findings, NBS released its own, lower estimate for China's Gini coefficient: 0.47. At a press conference in January, bureau Director Ma Jiantang explained that although it was high, inequality in China had been declining since 2008—a claim that is impossible to check because NBS did not release its sample selection method, complete data at the individual respondent level, or the nonresponse rate for the surveys underlying the calculations.

The bureau's attempt to steal the spotlight flopped. Chinese media seized on Gan's number, prompting an outcry online. The reported yawning income gap caused a big sensation, says Yu Xie, a sociologist at the University of Michigan, Ann Arbor, and Peking University, who is not affiliated with the survey. The controversy highlights just how volatile a reaction to new data can be in China. And it shows how difficult it is to derive accurate statistics when reports are distorted by government incentives and cloaked in secrecy. "The research community is really starving for data," says Zhao Yaohui, an economist with Peking University's China Center for Economic Research.

The accuracy and availability of data in China vary by field. But some themes crop up again and again: Cases are under- or over-reported, data are obtained but not released, and definitions and methodologies shift from one use to the next. These problems are more pressing now, as fields like sociology and economics are rapidly developing. The lack of access to good data, Zhao says, has become a "major hindrance to the advancement of the social sciences in China."

Deconstructing the data

The roots of China's problems are partly systemic; statistics get both too little and too much respect. A numbers-driven country, China has an "old, centralized administration that collects data on everything," says Carsten Holz, an economist who specializes in Chinese statistics at Hong Kong University of Science and Technology. Government officials are evaluated on indicators such as environmental protection rather than on their overall performance. Under the *yi piao fou-*

jue, or "one-vote down," system introduced in 1991, local officials who poorly perform in one of several key areas can face wage cuts or dismissal. As the saying goes, *shuzi chu guan*: "Numbers make leaders."

As a result, notes Liu Junguo, a hydrologist at Beijing Forestry University, the inverse is also true: *guan chu shuzi*, or "leaders make numbers." Scholars say that outright cooking of the books is rare, perhaps because it's a red flag: With data released consistently every month or every year, says Yong Cai, a demographer at the University of North Carolina, Chapel Hill, "it's very difficult to fake something in a systematic way without being caught." Instead, officials may change definitions so that one year's data are not comparable to previous years'. "Local officials are manipulating a little of the gray area rather than outright fabricating," says Kam Wing Chan, a geographer at the University of Washington, Seattle. But for scholars seeking accurate figures, this can be infuriating. As a result of political incentives, "all indicators of well-being" are suspect, Xie says.

For instance, in determining per capita gross domestic product (GDP) or the unemployment rate, a mayor may conveniently exclude millions of struggling migrant workers. Because they lack an urban residence permit, migrants are not counted in a city's population. When they are included, a city's report card can change dramatically, says Chan, who studies migration in China. With migrants excluded from the population of Shenzhen, a booming industrial city near Hong Kong, the city had a per capita GDP of about $21,700 in 2000. When migrants were counted, Chan found in a paper for the July 2007 issue of *Eurasian Geography and Economics*, the figure plummeted to $3900.

Compounding China's data woes are policies that encourage concealing information. Because of limits imposed by the one-child policy, some parents do not register births
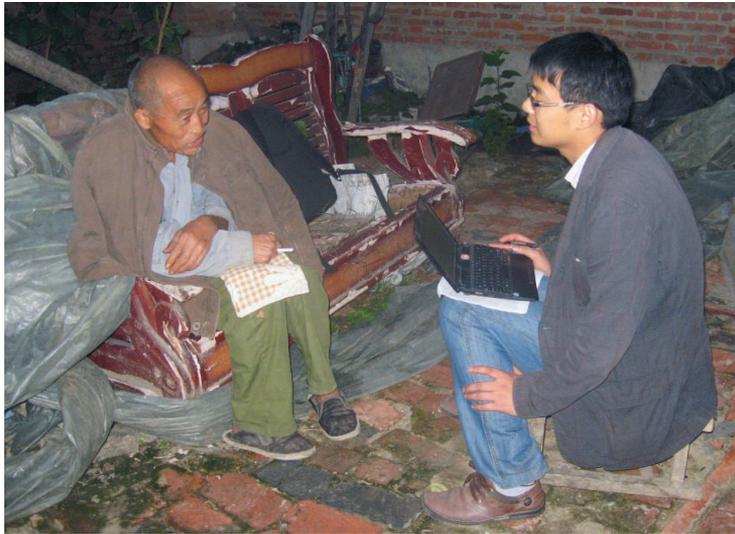
Reaching out. In rural Henan Province, a survey on household income sent interviewers out to gather data from a broad sample of citizens.

of second and third children, complicating attempts by demographers to track population changes. "If you want to get a timely number you have to rely on local numbers, and everyone knows those numbers are not reliable," Cai says. For a more accurate birthrate, demographers often wait a few years to see if unreported children crop up at the age when school enrollment begins.

NBS makes corrections to aggregate data for such misreporting. "They are aware of the limitations of data," Xie says. But because the bureau does not typically release complete data sets or detailed methodology, it is impossible for scholars to check how the numbers are modified. "They don't tell you how they got to where they got," says Avraham Ebenstein, an economist at the Hebrew University of Jerusalem who studies China. "So you don't know if the data are good and bad." An NBS spokesperson wrote in an e-mail that the bureau publishes information about the "subjects, survey methods, [and] statistical range" of its data.

NBS occasionally releases household income microlevel data, or data at the individual respondent level, but it does so only for a handful of provinces at once, according to several scholars—a tactic that prevents independent calculations of the Gini coefficient from official statistics. "The government is tremendously tight-fisted with these data," Ebenstein says. "It's as if, 'We want you to do research, but we don't want it to be too good.'"

Challenger. Gan Li's group found significant income disparity in China.

Global repercussions

Statistics are hardly the only research tool that Chinese officials view as dangerous in the wrong hands. Detailed topographic maps and GPS devices are tightly controlled as well (*Science*, 25 January, p. 384). But holding back data has a broader impact by tainting research not exclusively focused on China. Because global indices compiled by the United Nations and World Bank often incorporate figures furnished by Chinese government agencies, misleading statistics can skew global comparisons.

China's birthrate is a case in point. To correct for underreporting by parents and local officials, Cai says, NBS adjusts its estimate of the crude birthrate, but "we never know the mechanism." China's National Population and Family Planning Commission, which was recently combined with the health ministry, issues separate population projections that are even sketchier. Working backward from the figures, demographers can derive a total fertility rate, or the number of children the average woman is expected to have over her lifetime—and they contend that officials deliberately overestimate the rate. A high birthrate keeps the family planning commission in business: "High fertility is the very foundation of its existence," Cai says.

In 2008, the population commission's estimates sparked a debate when the United Nations Population Division (UNPD) released its biannual *World Population Prospects* report, with projections to 2050. Cai and demographer Gu Baochang of Renmin University of China in Beijing noticed that UNPD's estimates put China's total fertility rate for 2000 to 2005 at 1.77, close to the family planning commission's estimate of 1.73—and predicted that fertility would increase from there. The two demographers suspect that UNPD relied on a 2006 population commission survey that scholars widely consider biased. Invited to comment, they suggested lowering the estimate to about 1.5.

The appeal may have had some impact. Projections in UNPD's revised *World Population Prospects* in 2010 imply a total fertility rate of 1.70 for 2000 to 2005 and shows births declining after that. The shift is significant: The difference between the two reports' esti-

mates for global population in 2010 is 12.81 million people. "That can almost entirely be attributed to the adjustment of the Chinese population," Cai says.

Inside China, drama surrounding Chinese statistics extends beyond numbers. In 2006, NBS head Qiu Xiaohua was removed from his post after being investigated for involvement in a pension fund scandal. A Chinese Communist Party commission expelled him from the party for accepting bribes and keeping multiple wives, issuing a statement saying he had exerted "vile social and political influence." In recent years, NBS has become a favorite target of Chinese social media users. In one popular online jibe, commentators referred to the bureau as *tongji ju*, a homonym for its official name that means "the Bureau of Dicking Around."

Such jabs at the government's lack of transparency are gradually yielding change. Much as Gan's study appears to have provoked NBS to release its own Gini coefficient, outcry over incomplete air pollution data prompted the government in January to begin measuring concentrations of harmful particulate matter less than 2.5 micrometers in diameter for many Chinese cities (*Science*, 11 January, p. 124). "The government is under more and more pressure to release data of public interest," Xie says. In 2009, China introduced a regulation stipulating punishment for concocting statistics or encouraging others to do so (*Science*, 7 August 2009, p. 675). NBS also now regularly sends teams to check the methods of its local branch offices.

Some scholars say that data quality in their fields is improving. Liu notes that in recent years, when China's environment ministry was strictly monitoring water quality—boosting the incentive for local officials to clean up polluted rivers and lakes— official data nonetheless show a deterioration. For China-oriented researchers accustomed to reading the tea leaves, such depressing statistics are actually an encouraging sign that "the quality of statistics is improving," Liu says. Certain economic calculations are progressing as well, says Holz, who is editing an upcoming special issue of the *China Economic Review* focused on Chinese statistics. China has long been accused of doctoring its national GDP figures to maintain the impression of continued high economic growth. But although no evidence so far definitively shows that the NBS figures are correct, "nobody so far has been able to prove the NBS data wrong," Holz says.

But Chinese agencies are still a far cry from their U.S. counterparts, many of which employ scholars on rotation and staff liaisons to facilitate use of government data by outside experts. Ebenstein says that China is "just much more cautious" about letting results fall where they may. It doesn't help that intense pressure to publish makes many Chinese scholars reluctant to share what they have. "Traditionally," Zhao says, "people collect data and hold on to it— and don't let others use it." Xie agrees: "There is no norm for data sharing."

Playing the numbers. Critics say data-driven goals—such as China's one child policy touted in a poster have fueled statistical errors.

Upstart surveys

A growing number of scholars hope to change that culture by challenging what Xie calls NBS's "monopoly." The China Household Finance Survey is just one of several notable efforts to generate independent microlevel data. In the past 5 years, a number of similar longitudinal, nationally representative surveys have cropped up in China to fill the vast data holes. Among them are the Chinese General Social Survey, a project spearheaded by Renmin University's National Survey Research Center in Beijing that queries respondents on questions like religion, social inequality, and health; the Chinese University Student Learning and Development Follow-Up Research project, a survey tracking university students throughout their lives led by Tsinghua University in Beijing; the Chinese Family Panel Studies, a survey of 60,000 respondents on everything from child care to election participation run out of Peking University in Beijing (*Science*, 30 April 2010, p. 554); and the China Health and Retirement Longitudinal Study (CHARLS), also overseen by researchers at Peking University, which aims to shed light on issues faced by China's rapidly aging population.

Increased funding for social science research, both at universities and at China's government science institutions, is behind the new wave of surveys, says Zhao, a co–principal investigator for CHARLS. Her survey, which covers 17,500 respondents over age 45, is modeled in part after the University of Michigan's Health and Retirement Study. It benefited from an $813,000 grant from a program launched by the National Natural Science Foundation of China in 2012 to fund research that generates large data sets. CHARLS aims to release data within a year after a survey round, which is faster than many similar surveys in other countries. The independent surveys can be "used to either validate or check against government statistics," says Xie, who helped design the Chinese Family Panel Studies survey.

Officials need not instinctively fear the emergence of such upstart fact checkers, says Gan, who is planning to launch a new survey round for the China Household Finance Survey in July that expands his sample size by 50%. When he and colleagues arrived at a high Gini coefficient, he went back to find the study that, years ago, determined that 0.4 is the threshold for instability—and came up with no published papers on the topic. Instead, he found numerous studies suggesting that it is opportunity inequality, and not simply income inequality, that sparks instability. Although Gan believes that China should redistribute wealth, the explanation for its stability, he says, is that people in China "believe that they can move up, and there are also institutions helping them move up." For the moment, at least, "there is this mobility" in China.

Numbers like the Gini coefficient are not inherently threatening, Gan contends. It all depends on their interpretation.

–MARA HVISTENDAHL