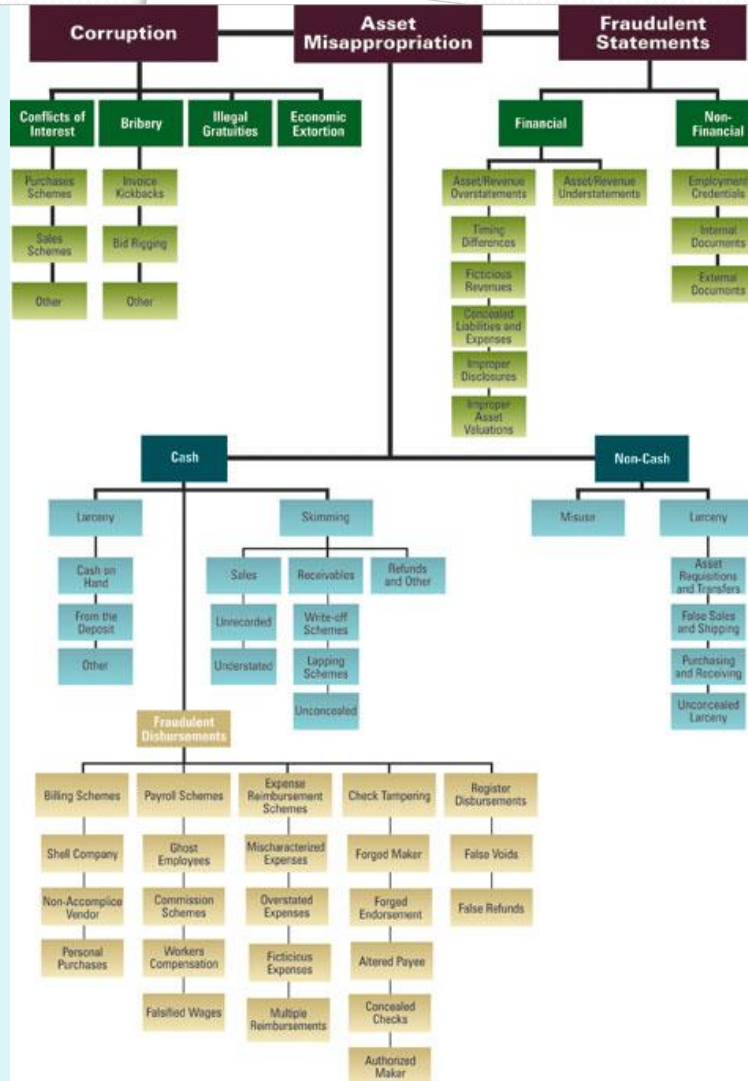


# Statistical Thinking For Data Science And Analytics

Recent studies regarding  
financial statement fraud

Dr. Mukaddas Parpidjanova

# Fraud Tree Classification System



# Measuring the Cost of Occupational Fraud



Fraud, by its very nature, does not lend itself to being scientifically observed or measured in an accurate manner. One of the primary characteristics of fraud is that it is clandestine, or hidden; almost all fraud involves the attempted concealment of the crime.

# Measuring the Cost of Occupational Fraud

- Consequently, many instances of occupational fraud may go completely undetected. Further, even for those cases that do come to light, the full amount stolen may not be ascertainable, or the victim organization may decide not to report the theft to the authorities or the general public. As a result, determining the true breadth and depth of this form of crime is nearly impossible.
- Even with these limitations, examining the impact of fraud on U.S. businesses is an important endeavor.
- While it is unlikely that we can accurately measure the true costs of occupational fraud at any given point in time, it is still useful to try to gain some understanding of the scope of the problem with which we are confronted.

# Measuring the Cost of Occupational Fraud

- Accordingly, we asked each survey participant to provide his or her best estimate of the percentage of annual revenues lost by the typical U.S. organization to fraud each year.
- The median response indicated that the typical U.S. organization loses 7% of its annual revenues to fraudulent activity. If this percentage were applied to the estimated 2008 U.S. gross domestic product of \$14.196 trillion\*, we could project that roughly \$994 billion would be lost to fraud in 2008.
- We want to make clear that this estimate is based solely on the opinions of CFEs who are in the trenches fighting fraud on a daily basis, rather than on any specific data or factual observations. Thus, this figure should not be considered a literal representation of the true cost of fraud facing U.S. organizations.

\*Based on U.S. Department of Commerce first quarter 2008 GDP estimate.

# Measuring the Cost of Occupational Fraud

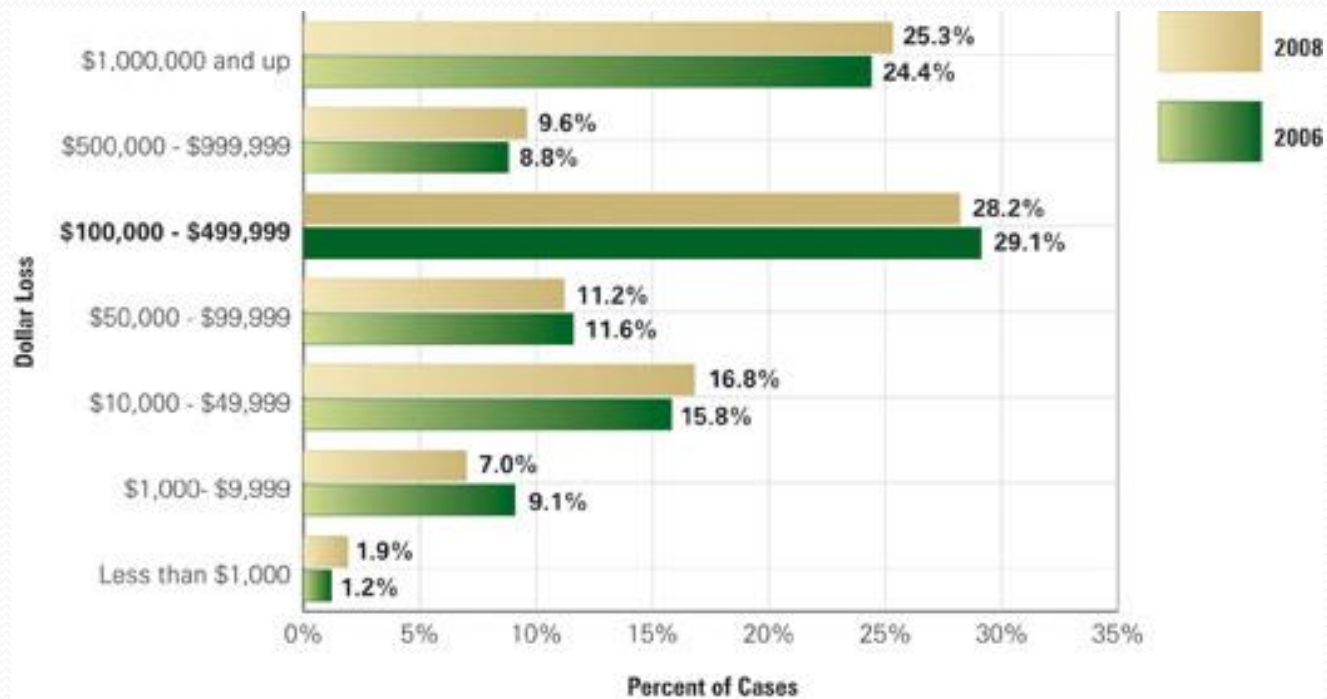
- As previously discussed, many obstacles stand in the way of accurately valuing the amount lost to all employee fraud. However, the 7% figure is a meaningful and insightful estimate that may be as close to a reliable measure of the cost of fraud as one can get. The figure provides a best-guess point of reference based on the opinions of 959 anti-fraud experts with a median of 15 years' experience in the prevention and detection of occupational fraud.

## **Distribution of Losses**

- Of the 959 cases of occupational fraud that comprised our study, 937 included the total dollar loss. The median loss for all schemes in the study was \$175,000. As the following chart shows, more than one-fourth of all cases in the 2008 study involved losses of at least \$1 million. The distribution of dollar losses among cases in the 2008 study was similar to the distribution in our 2006 Report; in both studies, more than 60% of schemes caused the victim organization to suffer a loss of at least \$100,000.

# Measuring the Cost of Occupational Fraud

## Distribution of Dollar Loss



# How Occupational Fraud is Committed



Based on previous ACFE research on and observations of the methods used to commit occupational fraud, we have broken down the schemes reported to us into three primary categories: asset misappropriation, corruption, and financial statement fraud.

# How Occupational Fraud is Committed

- Asset misappropriation schemes are frauds in which the perpetrator steals or misuses an organization's resources.
- Common examples of asset misappropriation include false invoicing, payroll fraud, and skimming.
- In the context of occupational fraud, corruption refers to schemes in which fraudsters use their influence in business transactions in a way that violates their duty to their employers in order to obtain a benefit for themselves or someone else.
- For example, employees might receive or offer bribes, extort funds from third parties, or engage in conflicts of interest.

# How Occupational Fraud is Committed

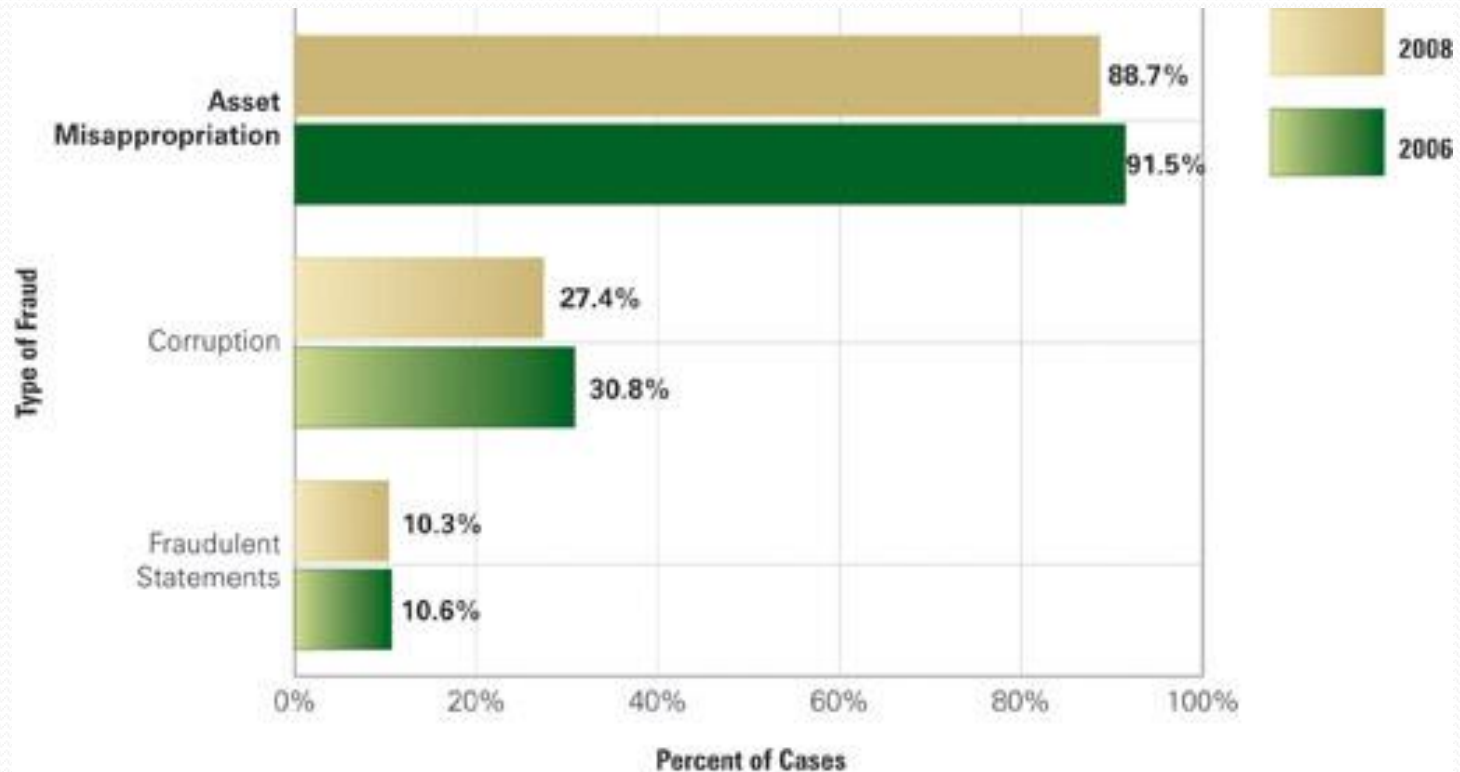
- The third category of occupational fraud, financial statement fraud, involves the intentional misstatement or omission of material information from the organization's financial reports; these are the cases of “cooking the books” that often make front page headlines.
- Financial statement fraud cases often involve the reporting of fictitious revenues or the concealment of expenses or liabilities in order to make an organization appear more profitable than it really is.

# How Occupational Fraud is Committed

- Continuing the trend from our previous surveys, asset misappropriation schemes were both the most commonly reported and the least costly of the three major categories of occupational fraud (although the median loss in asset misappropriation schemes was \$150,000, which is still quite significant).
- Fraudulent statements, on the other hand, were the least commonly reported type of occupational fraud, but they caused considerably more damage than frauds in the other two categories. The median loss caused by fraudulent statement schemes in our study was \$2,000,000, which dwarfed the losses in the other two categories.
- This finding was consistent with our earlier reports. As was the case in 2006, corruption schemes fell in the middle of the spectrum in terms of frequency and cost. Corruption occurred in just over one quarter of the cases we reviewed, with a median loss of \$375,000.

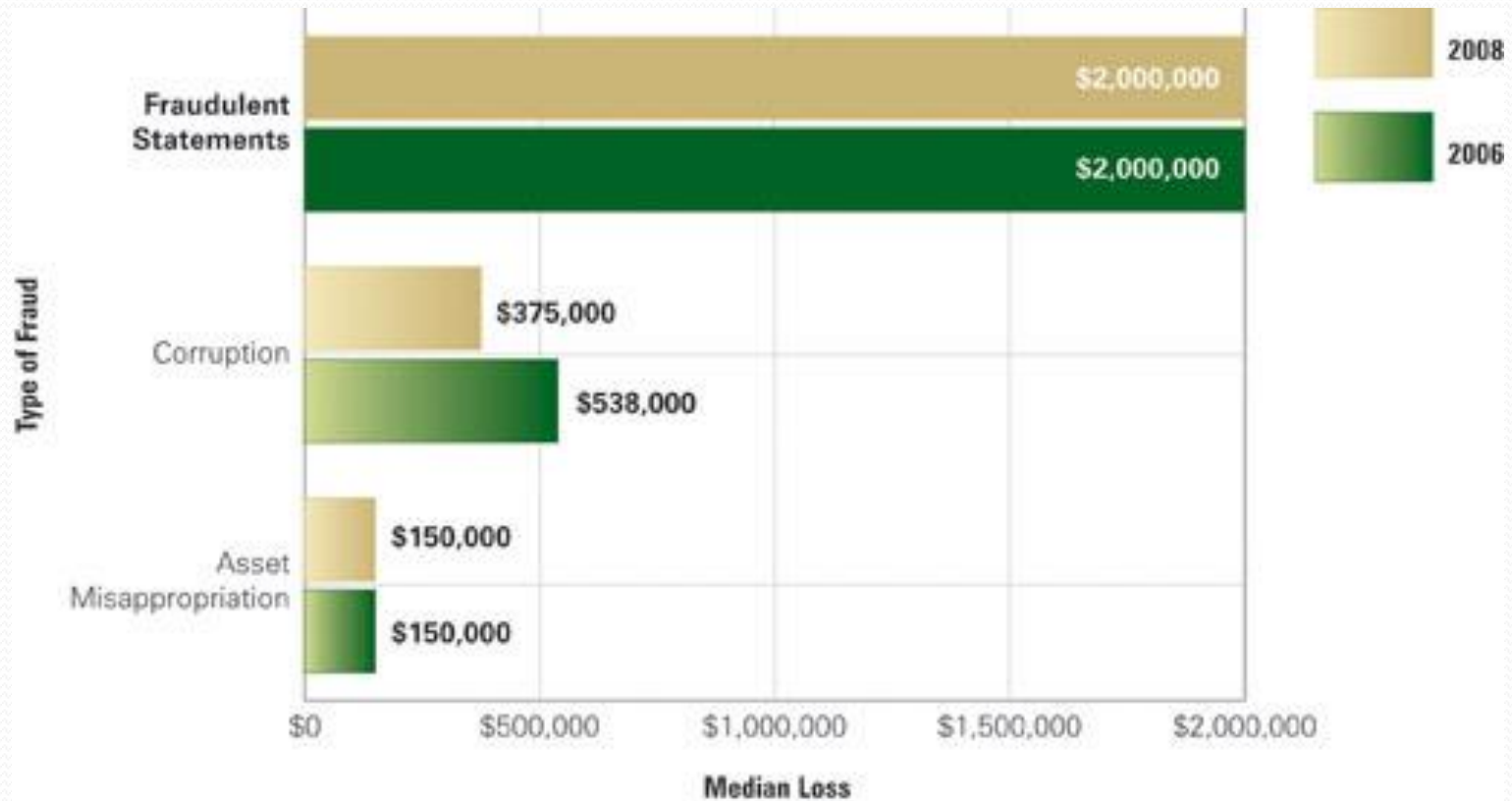
# How Occupational Fraud is Committed

Occupational Frauds by Category — Frequency



# How Occupational Fraud is Committed

## Occupational Frauds by Category — Median Loss



# How Occupational Fraud is Committed

## Comparison of the Methods Used to Commit Occupational Fraud

- Throughout this report, we will measure how different forms of fraud impact various types of organizations, as well as the most common schemes associated with different categories of fraud perpetrators. Because approximately 90% of all occupational frauds involve asset misappropriations, we need to focus on this category with more specificity in order to conduct a meaningful analysis of how fraudsters attack their organizations.

## Sub-Categories of Asset Misappropriation

- We subdivided asset misappropriation schemes into nine distinct categories, which are illustrated on the following page. The first two categories, skimming and cash larceny, are frauds that target an organization's incoming receipts.

# How Occupational Fraud is Committed

- The next five categories — billing schemes, check tampering, expense reimbursements, payroll schemes and cash register disbursements — target outgoing disbursements of cash. Cash on hand misappropriations involve the theft of cash or currency maintained onsite by the victim organization. The last category, non-cash misappropriations, involves the theft or misuse of physical assets such as inventory or equipment, or the misappropriation of proprietary information.
- As the following table illustrates, the majority of asset misappropriation schemes focus on cash, as opposed to other organizational assets. Eight of the nine categories target cash and overall, approximately 85% of all asset misappropriation cases in our study involved the theft or misuse of cash.
- Fraudsters who steal cash generally must access the money at one of three points within the victim organization: the point of receipt, the point of disbursement, or cash kept on hand.

# How Occupational Fraud is Committed

- As we see in the following table, fraudulent disbursements are the most common form of cash scheme. Billing schemes were the most commonly reported form of asset misappropriation, while check tampering and expense reimbursement fraud were each reported in over 100 cases.
- While not as common as fraudulent disbursements, schemes targeting cash receipts were also frequently reported; particularly skimming, which occurred in approximately one out of every six cases we reviewed.
- Schemes targeting cash on hand were less common than those involving receipts or disbursements, and the median loss of \$35,000 in cash on hand frauds was among the lowest of any category. Frauds targeting non-cash assets, on the other hand, were both relatively common (16% of cases) and relatively costly (median loss of \$100,000).

# How Occupational Fraud is Committed

## Asset Misappropriation Sub-Categories

Category	Description	Examples	Cases Reported	Percent of all cases <sup>2</sup>	Median Loss
<b>Schemes Involving Cash Receipts</b>					
Skimming	Any scheme in which cash is stolen from an organization <i>before</i> it is recorded on the organization's books and records.	<ul style="list-style-type: none"> <li>Employee accepts payment from a customer but does not record the sale</li> </ul>	159	16.6%	\$80,000
Cash Larceny	Any scheme in which cash receipts are stolen from an organization <i>after</i> they been recorded on the organization's books and records.	<ul style="list-style-type: none"> <li>Employee steals cash and checks from daily receipts before they can be deposited in the bank</li> </ul>	99	10.3%	\$75,000

# How Occupational Fraud is Committed

Schemes Involving Fraudulent Disbursements of Cash					
Billing	Any scheme in which a person causes his or her employer to issue a payment by submitting invoices for fictitious goods or services, inflated invoices, or invoices for personal purchases.	<ul style="list-style-type: none"> <li>Employee creates a shell company and bills employer for nonexistent services</li> <li>Employee purchases personal items, submits invoice to employer for payment</li> </ul>	229	23.9%	\$100,000
Check Tampering	Any scheme in which a person steals his or her employer's funds by forging or altering a check on one of the organization's bank accounts, or steals a check the organization has legitimately issued to another payee.	<ul style="list-style-type: none"> <li>Employee steals blank company checks, makes them out to himself or an accomplice</li> <li>Employee steals outgoing check to a vendor, deposits it into his own bank account</li> </ul>	141	14.7%	\$138,000
Expense Reimbursements	Any scheme in which an employee makes a claim for reimbursement of fictitious or inflated business expenses.	<ul style="list-style-type: none"> <li>Employee files fraudulent expense report, claiming personal travel, nonexistent meals, etc.</li> </ul>	127	13.2%	\$25,000
Payroll	Any scheme in which an employee causes his or her employer to issue a payment by making false claims for compensation.	<ul style="list-style-type: none"> <li>Employee claims overtime for hours not worked</li> <li>Employee adds ghost employees to the payroll</li> </ul>	89	9.3%	\$49,000
Cash Register Disbursements	Any scheme in which an employee makes false entries on a cash register to conceal the fraudulent removal of cash.	<ul style="list-style-type: none"> <li>Employee fraudulently voids a sale on his cash register and steals the cash</li> </ul>	27	2.8%	\$25,000
Cash on Hand Misappropriations	Any scheme in which the perpetrator misappropriates cash kept on hand at the victim organization's premises.	<ul style="list-style-type: none"> <li>Employee steals cash from a company vault</li> </ul>	121	12.6%	\$35,000
Non-Cash Misappropriations	Any scheme in which an employee steals or misuses non-cash assets of the victim organization.	<ul style="list-style-type: none"> <li>Employee steals inventory from a warehouse or storeroom</li> <li>Employee steals or misuses confidential customer financial information</li> </ul>	156	16.3%	\$100,000

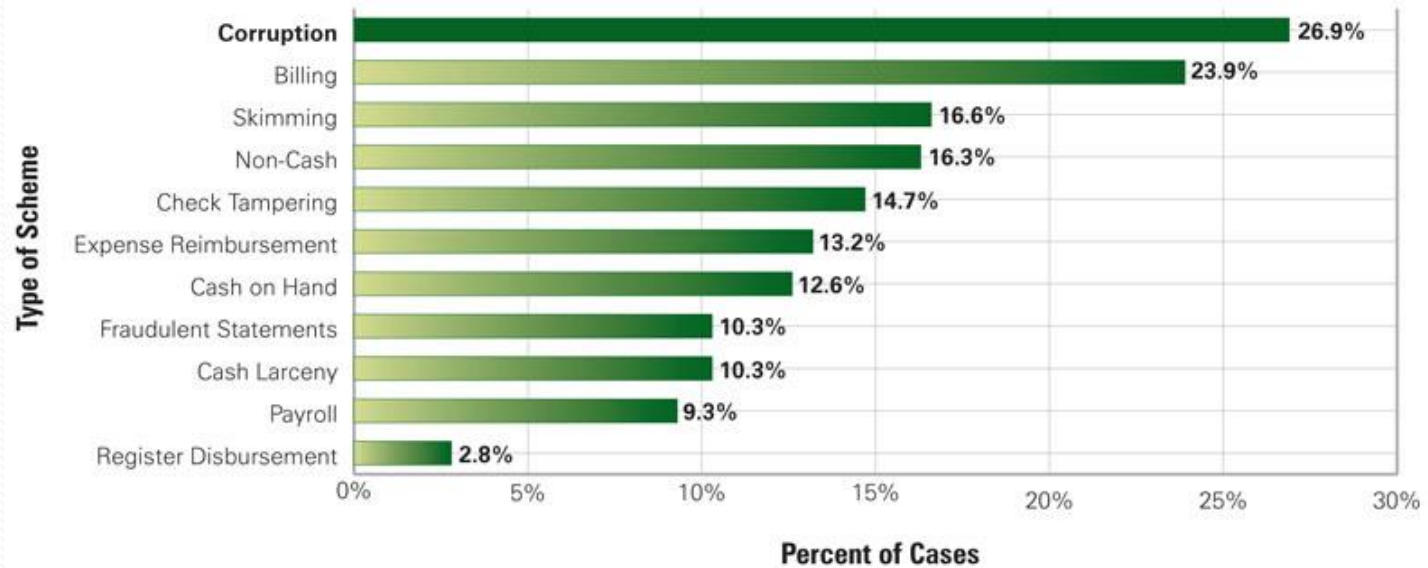
# How Occupational Fraud is Committed

## Comparison of Occupational Fraud Schemes by Frequency

- Once we have subdivided asset misappropriations into nine distinct subcategories, our analysis of particular fraud schemes takes on more meaning. We can study these particular forms of asset misappropriation alongside the categories of corruption and financial statement fraud. This analysis gives us a better understanding of the specific ways in which employees defraud their employers.
- As the chart below illustrates, corruption schemes were the most commonly reported form of fraud. Over one fourth of all the frauds in our study involved some form of corruption (paying or receiving bribes, engaging in conflicts of interest, extorting illegal payments or accepting illegal gratuities). Billing schemes were the next most common method of occupational fraud. Fraudulent billing was reported in about 24% of cases. Cash register disbursements and payroll fraud were the least-reported categories, each showing up in less than 10% of cases.

# How Occupational Fraud is Committed

## Breakdown of All Occupational Fraud Schemes — Frequency<sup>3</sup>



<sup>3</sup>The sum of percentages in this chart exceeds 100 percent because several cases involved multiple schemes from more than one category.

# How Occupational Fraud is Committed

## Comparison of Occupational Fraud Schemes by Median Loss

- When comparing the median losses caused by each of the 11 identified occupational fraud schemes, the first thing that jumps out is the great disparity between fraudulent statements and all other forms of fraud.
- As we noted earlier, the median loss caused by a fraudulent statement scheme was \$2,000,000, which was consistent with our findings in 2006.
- Fraudulent statements differ from other forms of occupational fraud in that the typical goal of a fraudulent statement scheme is not to directly enrich the perpetrator, but rather to mislead third parties (investors, owners, regulators, etc.) as to the profitability or viability of an organization.

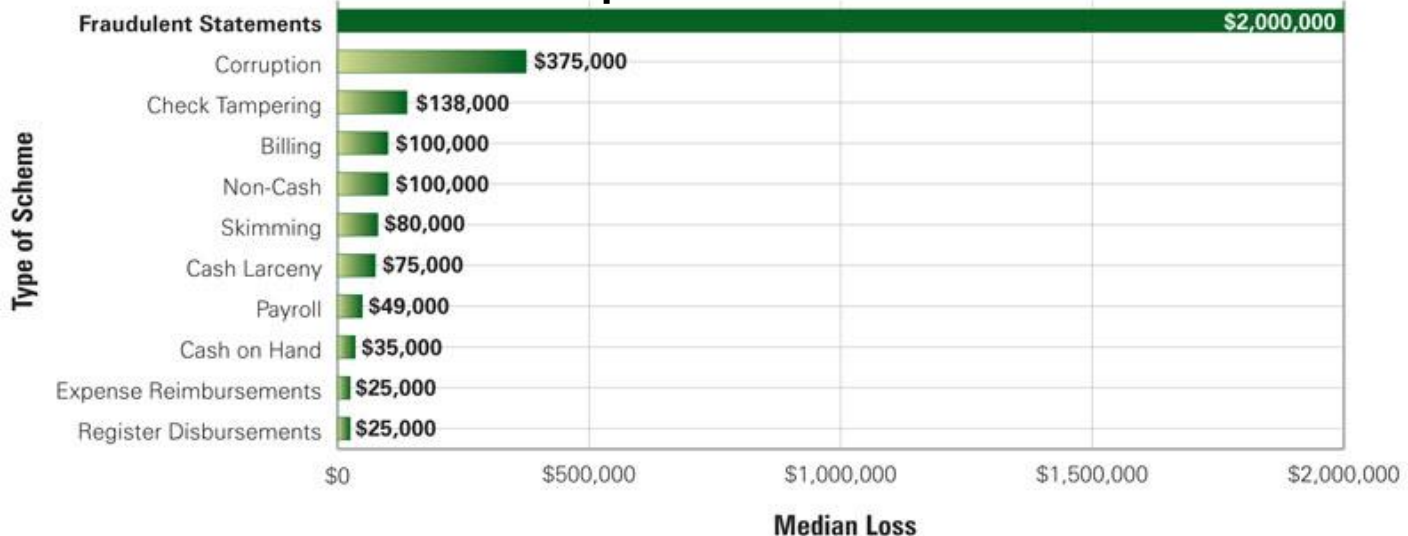
# How Occupational Fraud is Committed

- Thus, when we look at the losses resulting from financial statement fraud, we are often measuring lost market capitalization or lost shareholder value rather than direct loss of financial assets.
- In other words, a \$2 million fraudulent statement scheme may not involve the removal of \$2 million from the bank account of the victim organization.
- This does not make the scheme any less harmful; in fact, the lost shareholder value resulting from financial statement fraud can have crippling effects on even the largest companies, as we have seen with high-profile frauds such as Enron and WorldCom. It can also have a tremendous impact on the organization's shareholders.

# How Occupational Fraud is Committed

- However, it is important to remember, when comparing the losses caused by financial statement fraud and other schemes, that the financial statement losses have a different character than the losses resulting from the other forms of fraud, which by and large measure direct theft or misappropriation of a company's assets.

**Breakdown of All Occupational Fraud Schemes — Median Loss**

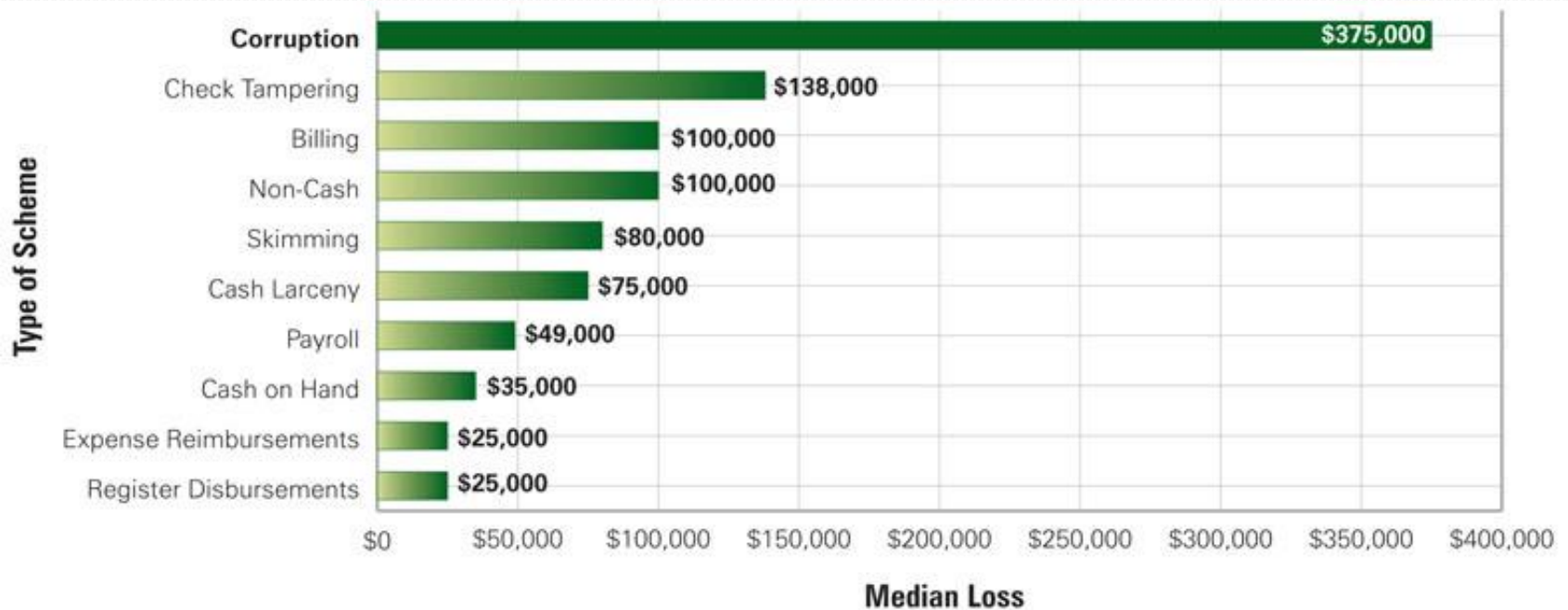


# How Occupational Fraud is Committed

- If we remove fraudulent financial statements from the preceding chart, we get a better view of the relative costs of the other 10 methods of occupational fraud that generally involve the direct theft or misappropriation of a victim organization's assets.
- In the next chart, we see that not only is corruption the most common occupational fraud scheme in our study, but it is also by far the most costly scheme other than financial statement fraud.
- The median loss resulting from a corruption case in our study was \$375,000, which was almost three times as large as the median loss resulting from check tampering, the next most costly scheme.
- Interestingly, the five most common asset misappropriation/corruption schemes were also the five most costly based on median loss.

# How Occupational Fraud is Committed

## Breakdown of All Occupational Fraud Schemes Excluding Fraudulent Financial Statements — Median Loss



# How Occupational Fraud is Committed

## Duration of Fraud Schemes

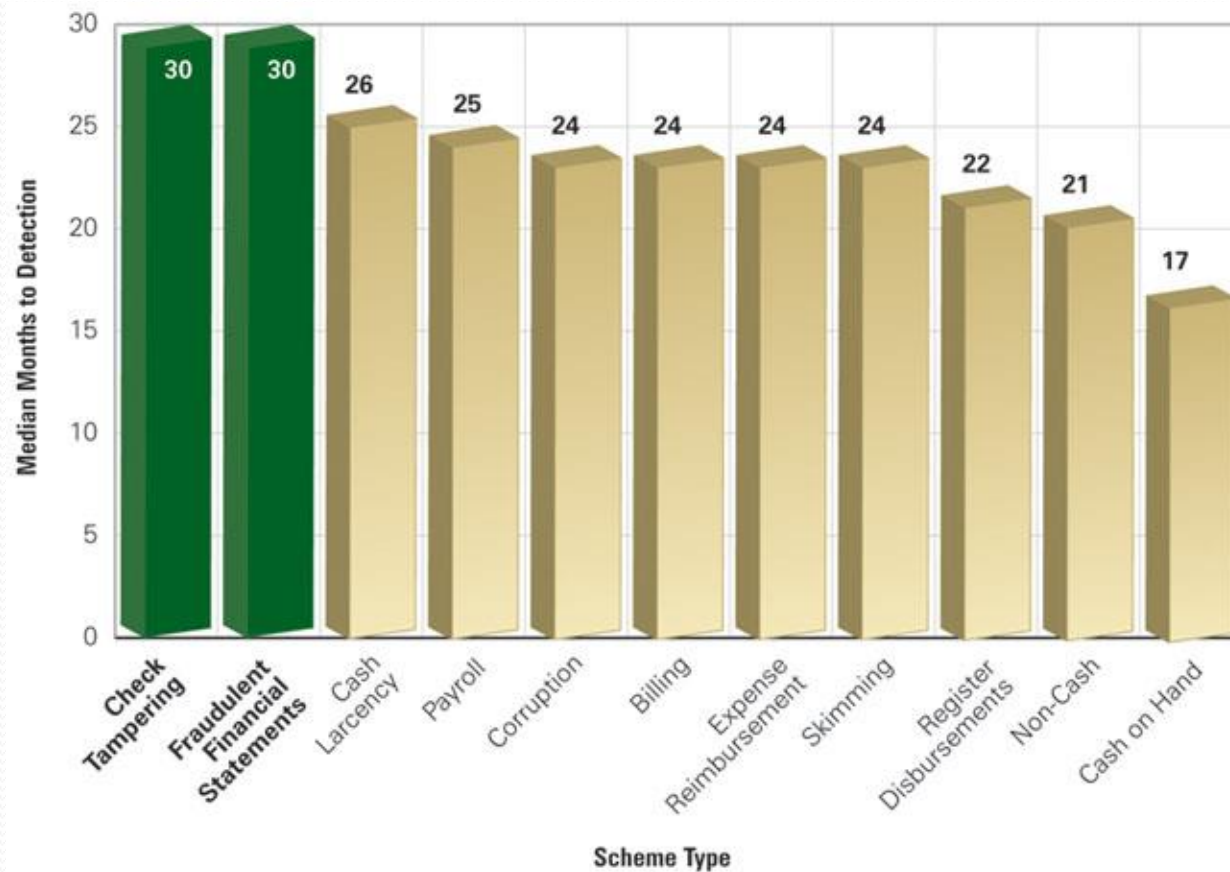
- One way occupational frauds differ from other forms of theft is that they are generally ongoing crimes that can last for months or even years before they are detected. This is one aspect of these crimes that makes it so difficult to precisely measure the true costs of fraud — at any given time, an organization may be the victim of fraud but yet be completely unaware of that fact.
- For instance, when a person holds up a bank and steals \$100,000, management of the bank immediately knows it has been robbed.
- On the other hand, when a bank teller issues \$100,000 worth of fraudulent wire transfers over the course of several months, the loss to the bank is the same, but management may have no idea it has been victimized.

# How Occupational Fraud is Committed

- Our study illustrates this problem by showing how long occupational fraud schemes tend to last before they are discovered.
- In 925 of the 959 cases included in our study, the respondent was able to tell us how long the scheme had lasted before it was detected. In these cases, the median length of time a fraud scheme went undetected was 24 months.
- This number varied based on the type of fraud undertaken by the perpetrator, as seen in the following table.
- Check tampering and fraudulent financial statement schemes had the longest median duration at 30 months, while schemes involving the theft of cash on hand were on the opposite end of the spectrum with a median length of 17 months before they were detected.

# How Occupational Fraud is Committed

## Median Duration of Fraud Based on Scheme Type



# Detection of Fraud Schemes



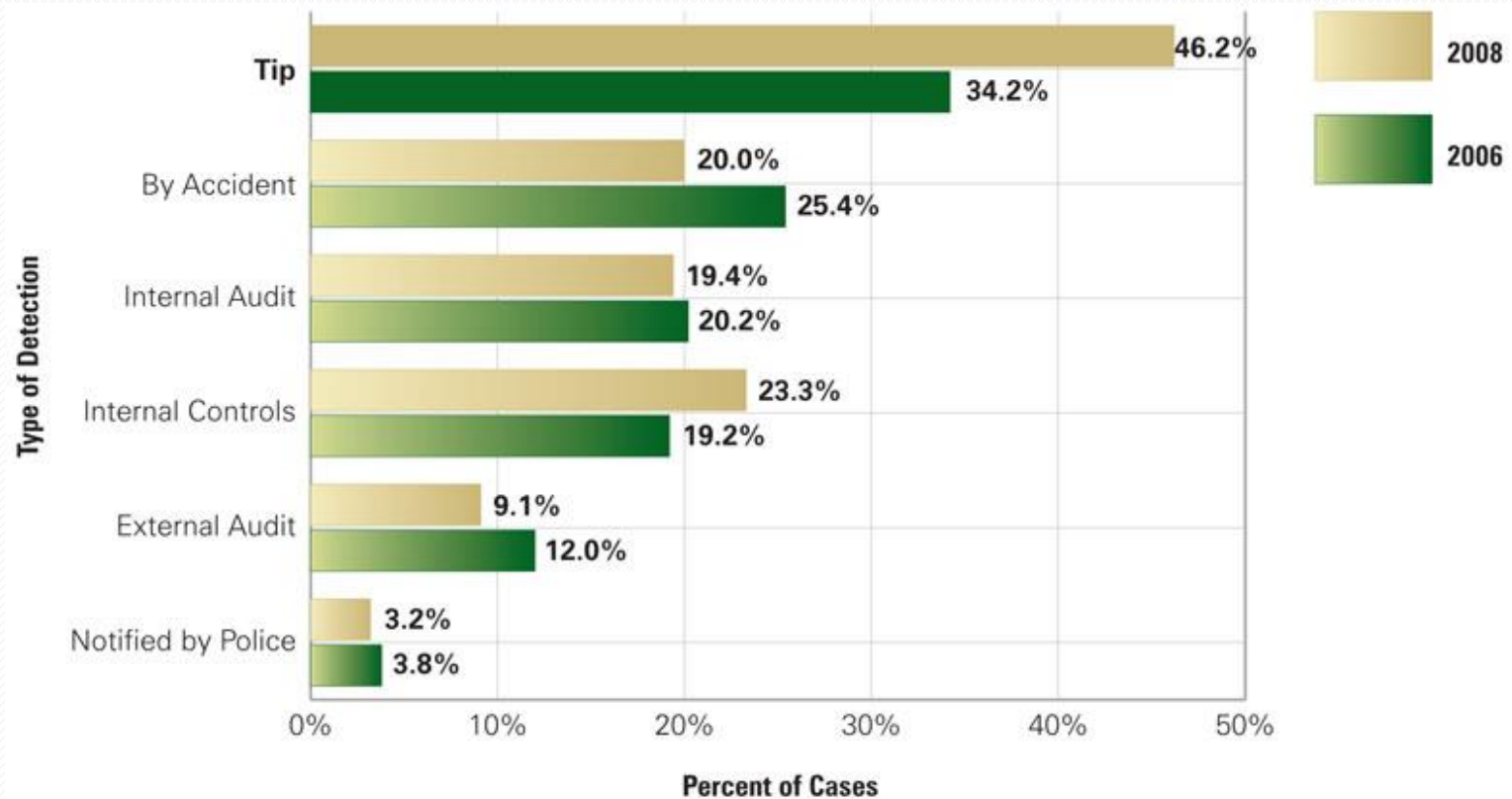
Respondents to our survey were asked to identify how the frauds were first discovered. Nearly half of the cases in our 2008 study were uncovered by a tip or complaint from an employee, customer, vendor, or other source.

# Detection of Fraud Schemes

- While tips have historically been the most common means of detection in our surveys, the percentage of fraud discoveries attributed to tips in 2008 is quite a bit greater than in 2006.
- It is encouraging to note that the percentage of cases discovered by accident was five percent lower than in 2006, while internal controls were credited with catching a slightly larger number of frauds.

# Detection of Fraud Schemes

## Initial Detection of Occupational Frauds<sup>4</sup>



<sup>4</sup>The sum of percentages in this chart exceeds 100 percent because in some cases respondents identified more than one detection method.

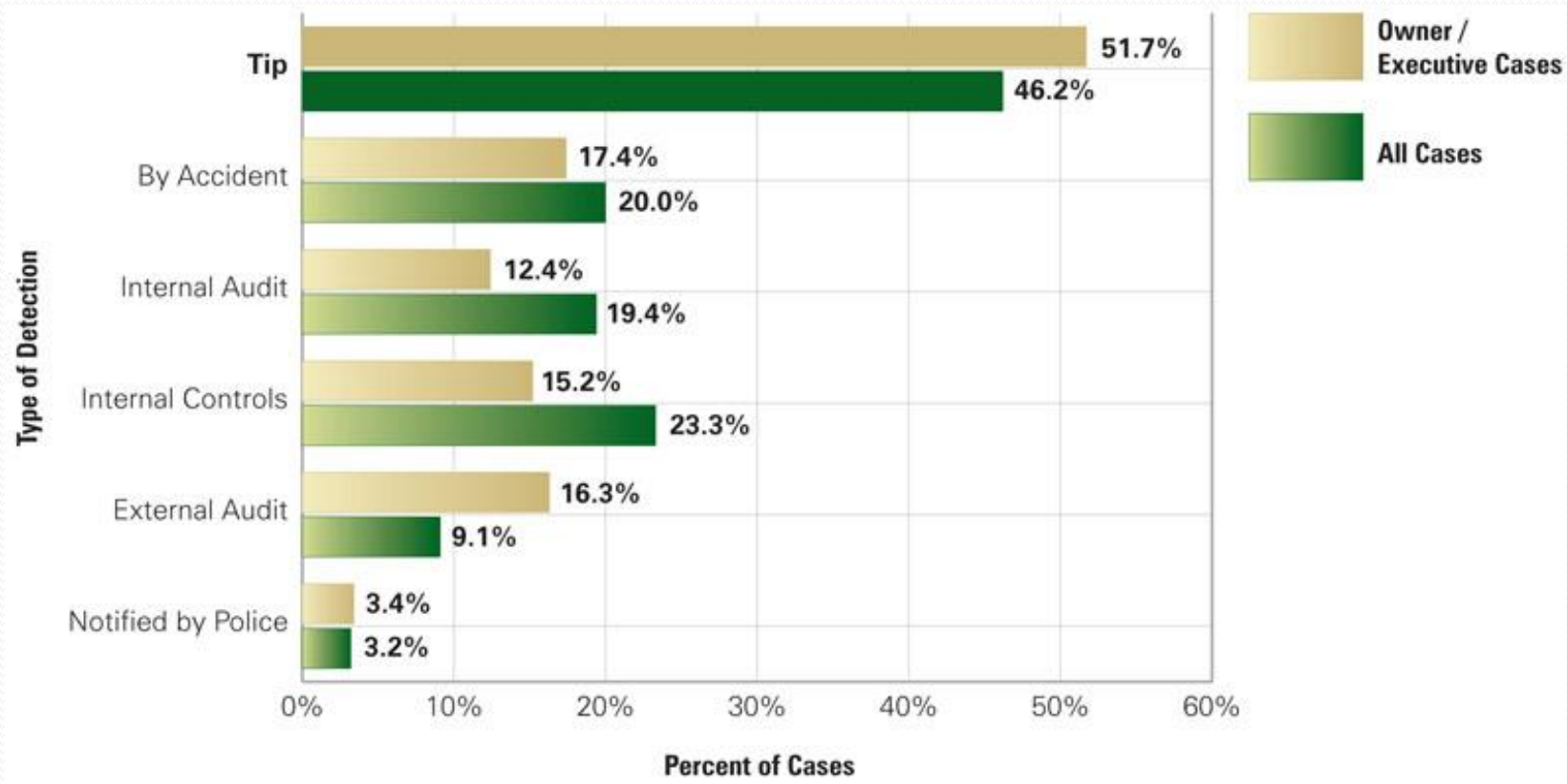
# Detection of Fraud Schemes

## Detecting Fraud Committed by Owners and Executives

- Tips were by far the most commonly cited detection method in cases that were perpetrated by owners and executives.
- Not surprisingly, internal controls were not as effective at detecting frauds committed by top-level perpetrators, as these individuals are often uniquely positioned to override even the best-designed controls.
- In contrast, external audits detected a greater percentage of cases involving owners and executives; this finding underscores the importance of independent assessments and external accountability as well as the need for auditors to be especially vigilant in reviewing transactions involving owners and executives.

# Detection of Fraud Schemes

## Initial Detection of Occupational Frauds by Owners/Executives<sup>5</sup>



<sup>5</sup>The sum of percentages in this chart exceeds 100 percent because in some cases respondents identified more than one detection method.

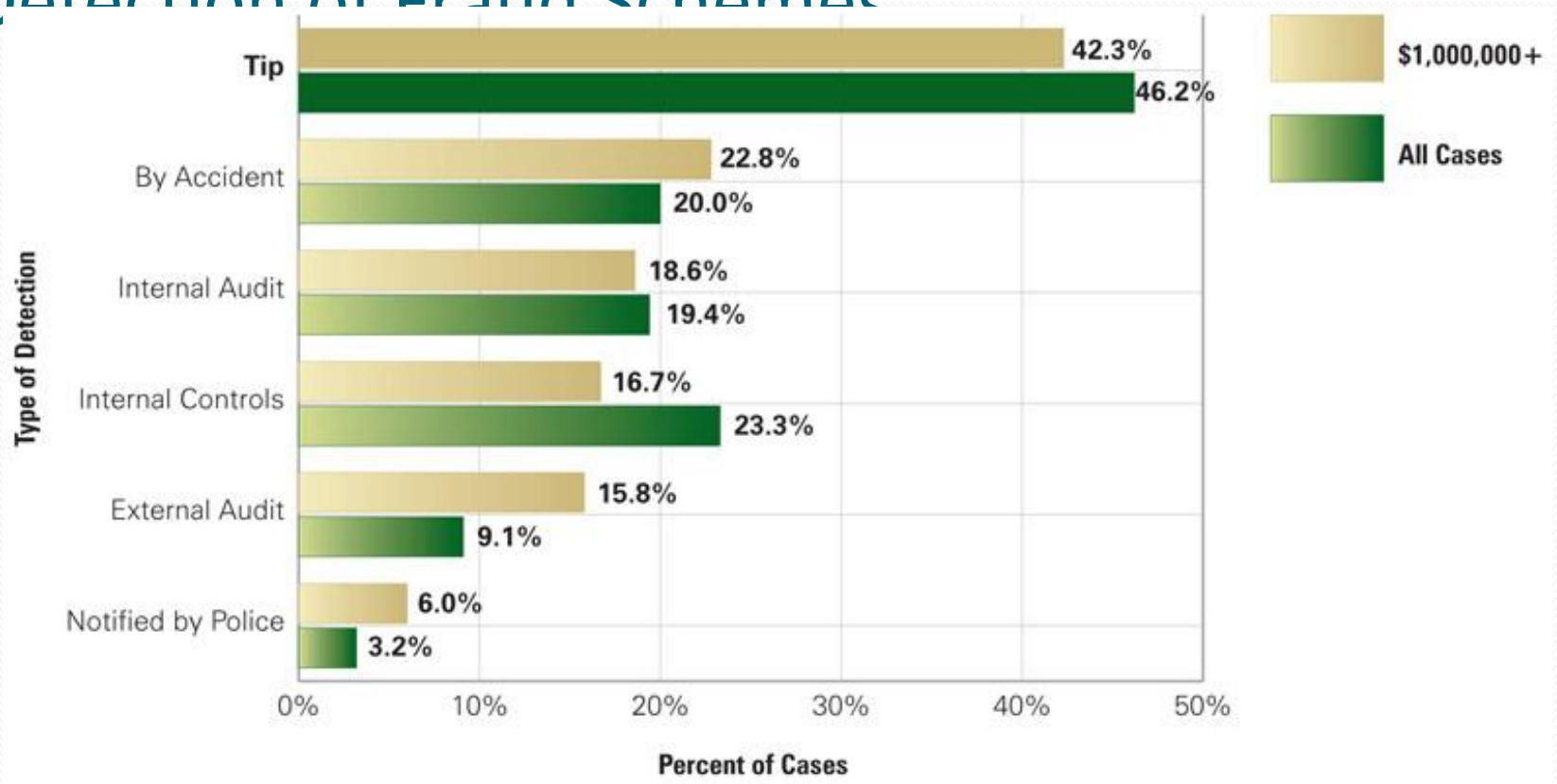
# Detection of Fraud Schemes

## Detecting the Largest Frauds

- The value of effective independent audits is illustrated by their role in detecting large frauds.
- Among the 237 cases involving a loss of \$1 million or more, external audits were cited as the detection method 16% of the time, as compared to 9% of all cases.
- Tips were the most common detection method for these cases with 42% of million-dollar frauds being uncovered through a tip or complaint.

# Detection of Fraud Schemes

## Initial Detection Method for Million Dollar Schemes<sup>6</sup>



<sup>6</sup>The sum of percentages in this chart exceeds 100 percent because in some cases respondents identified more than one detection method.

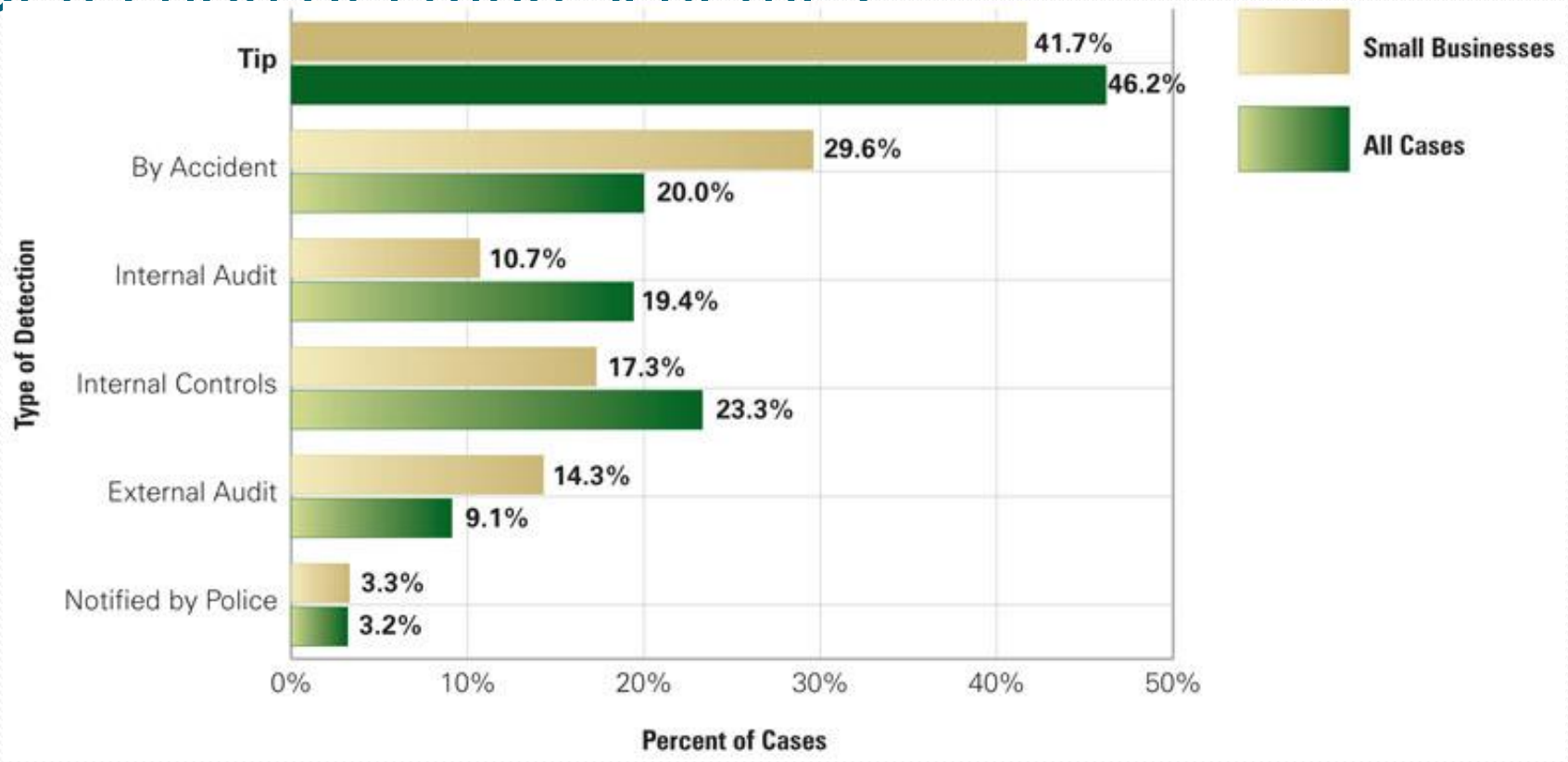
# Detection of Fraud Schemes

## Detecting Fraud in Small Businesses

- Small businesses (those with less than 100 employees) are typically thought to have fewer or weaker controls in place than their larger counterparts, primarily due to a lack of personnel or financial resources. The results of our survey bear this out, as a lower percentage of frauds in small businesses were caught by internal controls.
- Additionally, internal audits and tips were cited as the detection method in fewer small business cases than among all cases, while small business frauds were also more likely to be detected by accident.
- These findings indicate that small organizations have room for improvement in their proactive fraud detection efforts.

# Initial Detection Method of Frauds in Small Businesses<sup>7</sup>

## Detection of Fraud Schemes



<sup>7</sup>The sum of percentages in this chart exceeds 100 percent because in some cases respondents identified more than one detection method.

# Detection of Fraud Schemes

## Detection Methods by Organization Type

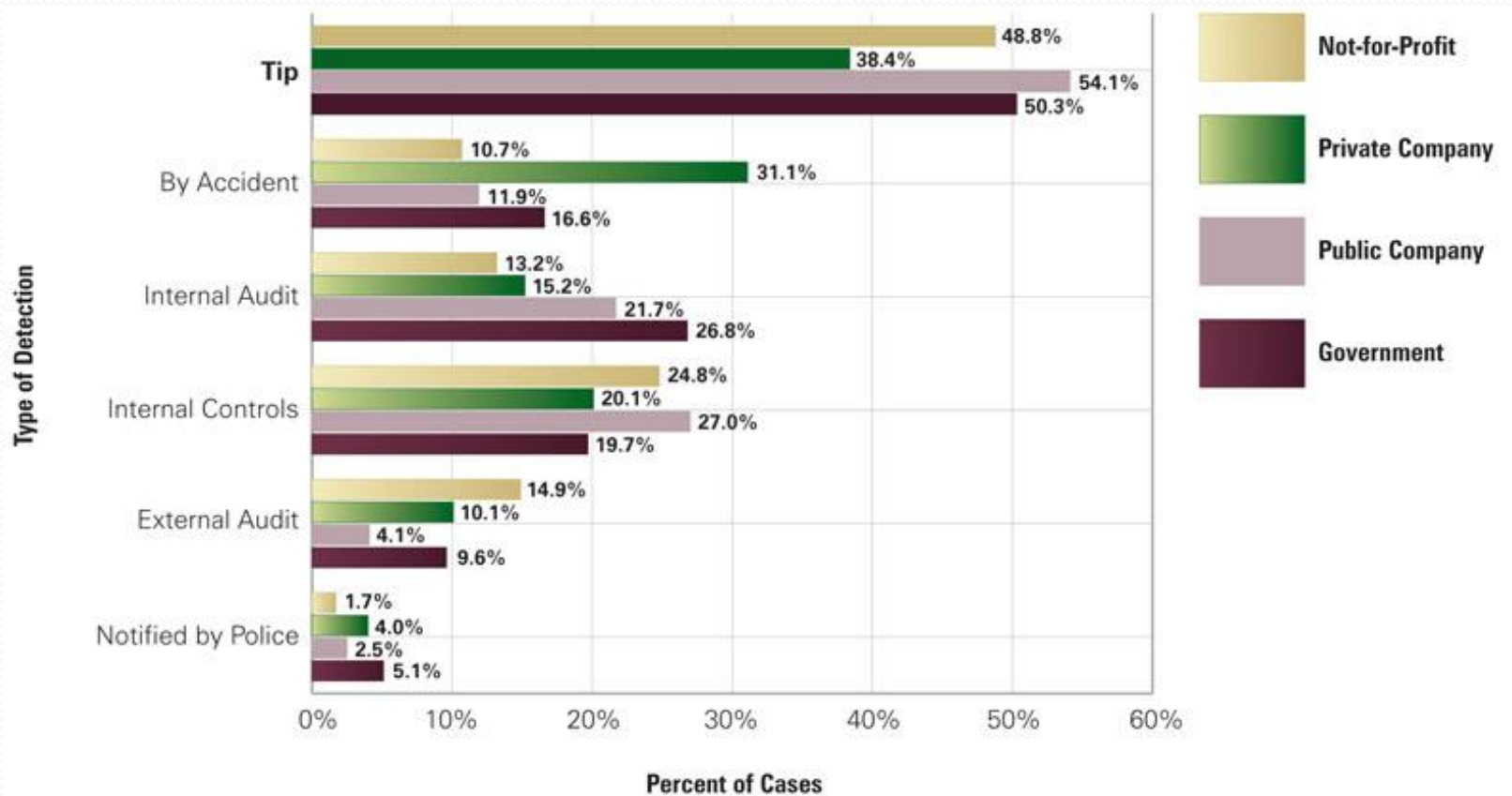
- In comparing detection methods based on the victim's organization type, we see that, with a few exceptions, the relative frequency of initial detection methods is generally consistent across the four categories of organizations.
- In each category, tips were the most common detection method, generally followed by internal controls and internal audits. The biggest deviation we found was in frauds at privately held companies. In these cases, frauds were initially detected by accident nearly a third of the time, which is a substantially higher rate than in any other organization type.
- It is not clear exactly why so many frauds at privately held companies were detected by accident as opposed to other methods, but we note that this result is similar to our 2006 Report, in which 35% of frauds in private companies were detected by accident. Private companies also experienced a smaller proportion of cases being reported through a tip or complaint.

# Detection of Fraud Schemes

- Internal audits were the source of detection in over a quarter of the government fraud cases, which exceeded the rate for any other type of organization.
- Surprisingly, publicly traded companies cited the smallest percentage of fraud detected by external audits even though they are the only organizations among the four categories that are generally required to undergo an independent audit.
- However, public companies also had the largest percentage of frauds detected through both tips and internal controls; this may reflect the continued impact of the Sarbanes-Oxley Act of 2002, which mandates the establishment of anonymous reporting mechanisms and increases the emphasis on strong internal control systems for publicly traded organizations.

# Detection of Fraud Schemes

## Initial Detection Method by Organization Type<sup>8</sup>



<sup>8</sup>The sum of percentages in this chart exceeds 100 percent because in some cases respondents identified more than one detection method.

# Detection of Fraud Schemes

## Tips

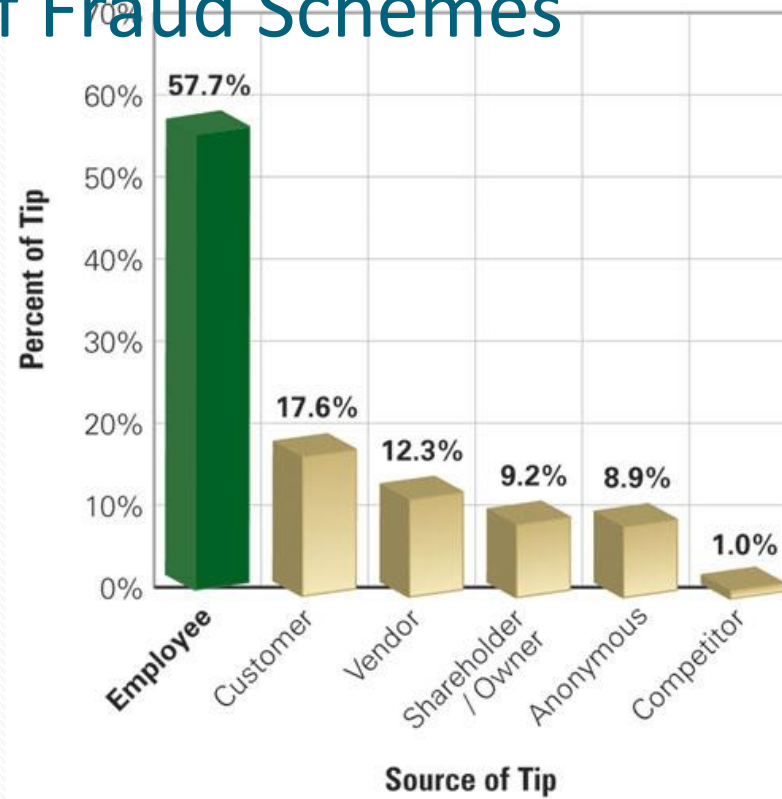
- Of the 417 cases in our study in which a tip or complaint was instrumental in the detection of the fraud, 31% were received via a hotline or other formal reporting mechanism.
- This is a relatively high number considering that less than half of the victim organizations in our survey had a formal reporting mechanism.
- The fact that tips continue to be the most effective means of detecting fraud suggests that organizations could improve their detection efforts by establishing formal structures to receive reports about possible fraudulent conduct.

# Detection of Fraud Schemes

- By far, the greatest percentage of tips came from employees of the victim organization, which is consistent with our findings in 2006. The fact that over half of all fraud detection tips came from employees suggests that organizations should focus on employee education as a key component of their fraud detection strategies.
- Employees should be trained to understand what constitutes fraud and how it harms the organization. They should be encouraged to report illegal or suspicious behavior, and they should be reassured that reports may be made confidentially and that the organization prohibits retaliation against whistleblowers.
- It is also worth noting that over 30% of tips came from external sources. While training and educating employees about reporting fraud is clearly an important step, organizations should also involve these third parties in their fraud detection programs by making them aware of the organization's reporting mechanism and encouraging them to report improper conduct.

# Detection of Fraud Schemes

## Percent of Tips by Source<sup>9</sup>



<sup>9</sup>The sum of percentages in this chart exceeds 100 percent because in some cases respondents identified more than one source of the initial tip.

# Reference

- Adventures in Financial Data Science: The empirical properties of financial data and some other things that interested me... Book 1 of 2: Financial Data Science | by Graham Giller | Nov 17, 2020
- Statistical Analysis of Network Data with R (Use R!) Part of: Use R! (70 Books) | by Eric D. Kolaczyk and Gábor Csárdi | Jun 3, 2020
- Statistical Data Analysis Using SAS: Intermediate Statistical Methods (Springer Texts in Statistics) Part of: Springer Texts in Statistics (70 Books) | by Mervyn G. Marasinghe and Kenneth J. Koehler | Apr 23, 2018
- A Common-Sense Guide to Data Structures and Algorithms, Second Edition: Level Up Your Core Programming Skills by Jay Wengrow | Sep 1, 2020
- Statistical Data Analysis (Oxford Science Publications) by Glen Cowan | Jun 4, 1998
- How to do Linguistics with R: Data exploration and statistical analysis by Natalia Levshina | Nov 25, 2015