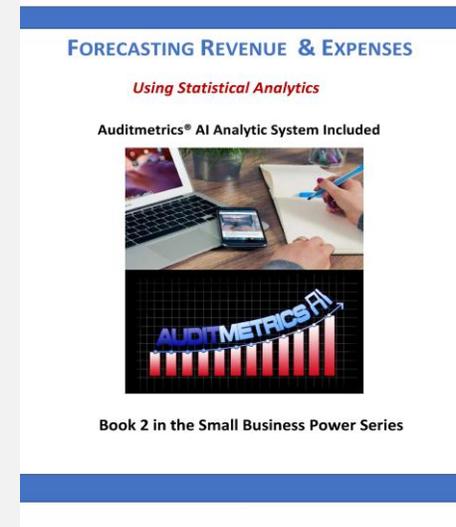


Microsoft Certified Software

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- *AUDITMETRICS® AI-SYSTEMS*
JOSEPH BOFFA
- *SPRINGER® PUBLISHING*



Primer of Audit, Forecasting & Market Research

With References From:

AI Assisted Business Analytics
Techniques for Reshaping Competitiveness

Forecasting Revenue & Expenses*

For the best use of your time, download the free version of Auditmetrics v6.5 and GettingStarted.pdf with its link to practice data files. [Auditmetrics AI](#)

Based on Boston University course "Healthcare Management and Finance"

****Purchase of Auditmetrics® Pro V7 includes a free "Forecasting Revenue & Expenses" by Eleanor Winslow***

AI Analytics Case Study

Building Statistical Business Data Analytics and Forecasting

The cashflow case study 1: Managing Cashflow on Springer page 13 compares the operating cashflow budget with the income statement. It indicates cashflow being considerably lower than income. The main cause was a failure of managing accounts receivable. The solution was to conduct an internal statistical audit of the annual sales account. The auditor determined which transactions followed well-defined A/R procedures and those that failed. Ultimately problems were uncovered and cashflow improved.

To take full advantage of the full potential of AI analytics including forecasting and market research, it was decided to audit 2 ½ years of revenue following the same auditing process as was for the periodic audit to improve cashflow. Auditmetrics AI v6.5 was used to select a random sample for analysis. The auditor decided to use a precision of .07 though the gold standard is .03. The auditor wanted to have a smaller sample size as a preliminary look at account data. A .07 precision will generate a sample size approximately 40% smaller than .03 precision reducing cost. However, if regular smaller cost-effective monitoring audits are used, over time that will achieve the same statistical power as one big large sample.

Statistical Audit Monitoring tools

- Regular sales and expense audits can assure cost effective administration of business operations
- With Auditmetrics AI the sample selection process will take only a matter of minutes
- Every calculation conforms to AICPA and IRS published standards
- Auditmetrics advancement in analytics allows for greater data driven testing of ideas.
- Many businesses start with a business plan based on logic and reason which can easily create a false sense of confidence that can lead one astray.
- Successful entrepreneurs behave more like scientists searching for evidence of their ideas' usefulness.
- The Auditmetrics audit tools are a prelude to the much broader and challenging realms of forecasting and market research
- If you follow the learning by doing system of Auditmetrics, you will soon be pleased with your advancement of knowledge.
- Our goal is you make professional and business decisions and AI as your assistant not the final authority.
- That requires a quest for building of a knowledge and consistently testing ideas

First task is to clearly define audit population to be sampled

Audit population is the total book of account transactions or invoices from which the sample is to be drawn:

- The most important decision is to determine which transactions should be included in the audit population
- Make a distinction between cashflow items and those as a function of tax law such depreciation book costs.
- Must take into account the time gap between documented sales based on accrual standards and actual cashflow payments
- The mixing of non-cashflow and cashflow items can lead to confusion

Getting Started with Auditmetrics®

Detail Stratum does not rely on a sample but a review of 100% of the transactions. High dollar volume transaction with the greatest economic impact are removed from statistical error.

Auditmetrics AI 6.5 Learning Version

for help: info@Auditmetrics.com

Detail ←

No. Strata ←

Precision ←
(Margin of Error)

Efficiency

Total Sample

Sample Size Excel File

Sample Validation Excel File

Potential Detail Cutoffs

1. Sample Size Calculations

There are only three required inputs by the user.

Auditmetrics does the heavy lifting in the AI Assisted background.

Auditmetrics will analyze account data and provide feedback about options to meet AICPA standards. Excel sample and reports are generated to conduct Audit and provide documentation.

Revenue Account to be Sampled

- N= 21,656 Required Auditmetrics Variables are Red *

Transaction_ID	VENDOR_NUMBER	amount	absamt	TxDate	ACCOUNT	DataSet	ZipCode	CustomerID
6214	506	\$5.00	\$5.00	3/1/2020	5060	Acme Inc.	20134	15060
1154	555	\$5.00	\$5.00	2/1/2020	5050	Acme Inc.	20136	15550
2435	555	\$5.00	\$5.00	1/1/2021	5050	Acme Inc.	20134	15550
4054	555	\$5.00	\$5.00	4/1/2019	5060	Acme Inc.	20135	15550
7933	555	\$5.00	\$5.00	11/1/2020	5060	Acme Inc.	20137	15550
7941	555	\$5.00	\$5.00	11/1/2020	5060	Acme Inc.	20136	15550
7942	555	\$5.00	\$5.00	11/1/2020	5060	Acme Inc.	20136	15550
9904	555	\$5.00	\$5.00	5/1/2021	5060	Acme Inc.	20134	15550
20713	570	\$5.00	\$5.00	9/1/2020	6245	Acme Inc.	20137	15700
"	"	"	"	"	"	"	"	"

*Software & Getting Started.PDF: [AuditmetricsAI.com](https://www.auditmetrics.com)

Self-learning tutorial on web site has the dataset used in this exercise

Sample Size Inputs->Precision = .07, #Strata = 5, Detail Cutoff=1600 – inputs to generate sample size n = 721

This random sample tested OK by Auditmetrics, can be used for audit

Total Sample

- Sample Size Excel File
- Sample Validation Excel File

This sample has passed all of the statistical validity tests for an audit review. The selected button above now creates the sample and generates an Excel template to summarize audit results

Select Another Audit Population?

Population:

N	Mean	Total \$
10101	19.02	192150.03
5776	91.67	529492.47
2813	258.69	727690.32
1614	548.66	885532.28
888	1106.04	982160.59
463	1880.24	870548.95

Sample Summary:
Validation Tests Listed Below

n	Mean	SD.	Total \$		
47	18.72	13.48	880	ok	ok
49	91.95	34.35	4506	ok	ok
52	243.26	115.06	12649	ok	ok
54	556.36	120.4	30043	ok	ok
56	1141.6	234.2	63930	ok	ok
463	1880.24	632.25	870549		

Validation #1- Observed precision under 0.07 no need to resample

Validation #2- Strata specific test passed.

AI Software Generated Excel Summary Template With All Strata Passing Validity Tests

Acme Inc.									
	Population			Sample			Strata Validity Test		
Strata	Pop. Mean	Pop.Total Value	Pop. Freq.	Sample Mean	Sample Total Value	Sample Size	Lower 5% Alpha Bound	Upper 5% Alpha Bound	
0 -49.99	\$19.02	\$192,150	10,101	\$18.74	\$881	47	13.31	\$24.16	pass
50-174.99	\$91.67	\$529,492	5,776	\$91.66	\$4,491	49	75.32	\$108.00	pass
175-399.99	\$258.69	\$727,690	2,813	\$276.94	\$14,401	52	257.31	\$296.56	pass
400-824.99	\$548.66	\$885,532	1,614	\$560.72	\$30,279	54	504.04	\$617.40	pass
825-1600	\$1,106.04	\$982,161	888	\$1,139.65	\$63,821	56	1,017.31	\$1,262.00	pass
> 1600	\$1,880.24	\$870,549	463	\$1,880.24	\$870,549	463			
Total (Excluding Detail)		\$3,317,026			\$113,872	258			
Total (Including Detail)		\$4,187,575			\$984,421	721			

Once sample is tested as valid
Auditor must set concise audit objectives

*Imprecise objectives will lead to imprecise results
no matter the level of mathematical precision*

- Take time at the beginning of the audit to consider the audit objective.
- Ensure that you have the proper criteria and audit steps to allow you to deliver on the audit objective.
- Clearly defined objectives improve the efficiency, effectiveness and scope of the audit and provide a quantified, defensible financial impact statement.
- "To improve the operations of Account Receivable" is too vague
- Difficult to answer this answer with a **“yes” or “no”**

Example: Accounts Receivable

- A more appropriate audit objective would be:
- "The accounts receivable process supports the timely and proper management of reviewed invoices".
- Now this is something an auditor can conclude Yes or No.
(Were the controls followed, are they adequate and effective or are the controls not adequate, ineffective or not followed)
- With properly defined objectives, you have a better idea of how analytics can be used to support the audit.

Accounts Receivable (Cont.)

Criteria One:

- **Timeliness**
- Examine the payment terms, invoice date, and identify late/early payments
- On average, an acceptable time line for collecting accounts receivables should not be more than one third longer than your credit period. For example, you may allow customers to pay within 30 days but allow up to 40 days.
- How many account entries greater than 60 days which are not compliant with timeliness criterion.
- Are the reviewed invoices both timely and clearly documented? Can conclude with yes or no. If no, then reviewed invoice is not compliant and its dollar amount need further review.

Criteria Two:

Was an Approved Well Defined A/R Process Followed?

- Was approved well-defined A/R published documentation followed?
- Were adequately trained staff processing the invoices that led to A/R?
- Were documentation recording standards including customer signatures and dates verified?
- Were tracing of A/R invoice with account books carried out?
- Does the manager of A/R follow through with clear standards of amount of credit to extend, reasonable consideration of risk, the value of the service, and the customer's ability to pay including past performance.
- Were payment requirements clearly defined and followed up
- In medical offices is there a clear process for linking insurance coverage claims and copayments?

With listing of criteria as yes or no, the auditor can determine the proportion of transactions that pass the audit or those that fail and are in error.

AI Generated Audit Sample n=721 Used for Audit

	A	B	C	D	E	F	G	H	I	J	K
1	Count	Transaction_ID	VENDOR_NUMBER	amount	absamt	TxDate	ACCOUNT	DataSet	ZipCode	CustomerID	Strata
2	1	4227	555	\$5.76	\$5.76	4/1/2019	5060	Acme Inc.	20136	15550	1
3	2	8019	506	\$6.33	\$6.33	11/1/2020	5060	Acme Inc.	20134	15060	1
4	3	9814	506	\$6.66	\$6.66	5/1/2021	5060	Acme Inc.	20134	15060	1
5	4	16355	2698	\$7.16	\$7.16	3/1/2020	5860	Acme Inc.	20134	36980	1
6	5	12658	676	\$7.85	\$7.85	3/1/2020	5705	Acme Inc.	20135	16760	1
7	6	9489	506	\$8.33	\$8.33	4/1/2021	5060	Acme Inc.	20136	15060	1
8	7	9447	566	\$8.35	\$8.35	3/1/2021	5060	Acme Inc.	20136	15660	1
9	8	6164	566	\$8.59	\$8.59	3/1/2020	5060	Acme Inc.	20135	15660	1
10	9	22970	699	\$16.45	\$16.45	9/1/2020	6295	Acme Inc.	20134	16990	1
11	10	22311	524	\$8.85	\$8.85	3/1/2021	6245	Acme Inc.	20134	15240	1
12	"	"	"	"	"	"	"	"	"	"	"
715	714	24328	3028	\$2,400.00	\$2,400.00	8/1/2019	6838	Acme Inc.	20134	40280	6
716	715	11563	3118	\$2,400.00	\$2,400.00	4/1/2021	5530	Acme Inc.	20134	41180	6
717	716	23628	2380	\$2,403.32	\$2,403.32	5/1/2021	6650	Acme Inc.	20134	33800	6
718	717	17987	2078	\$2,406.15	\$2,406.15	5/1/2021	5860	Acme Inc.	20136	30780	6
719	718	25183	2894	\$2,415.00	\$2,415.00	11/1/2020	6850	Acme Inc.	20135	38940	6
720	719	25055	3941	\$2,415.00	\$2,415.00	6/1/2020	6850	Acme Inc.	20137	49410	6
721	720	15161	2333	\$2,420.00	\$2,420.00	8/1/2020	5835	Acme Inc.	20137	33330	6
722	721	3314	412	\$2,422.00	\$2,422.00	6/1/2021	5050	Acme Inc.	20137	14120	6

Sample Audit Summary*

	Sample		Audit Results		
Strata #	Sample Total Value	Sample Size	Amount Error	Error Ratio	Pop. Est. Error Amt.
Stratum 1	\$899	47	\$48.16	0.054	\$10,291.65
Stratum 2	\$4,277	49	\$151.48	0.035	\$18,752.82
Stratum 3	\$12,523	52	\$741.70	0.059	\$43,097.59
Stratum 4	\$28,716	54	\$1,880.36	0.065	\$57,985.23
Stratum 5	\$62,075	56	\$1,334.00	0.021	\$21,106.63
Aud 100	\$870,549	463	\$25,972.00	0.030	\$25,972.86

* Springer pg. 47 ratio estimate of total estimated dollars that failed audit standard

Review of the Audit Process

The steps of designing the sample were selected to enhance the precision of sample estimates:

1. Determine outlier strata or detail for review at 100%
2. Stratify remaining population for sample size calculation using available range from 3% to 10% and 95% confidence interval which is built in.
3. Target efficiency factor to be .70 or better is ideal, .60-70 would be ok. *Changing number of strata or detail cutoff can be of help in fine tuning statistical efficiency**.
4. Only proceeds when Auditmetrics two validity checks are passed.

* Springer Pg 41-45

Audit Results Summary

- After the preliminary audit of accounts receivable the auditor found that there were still some cashflow problems to be solved.
- The auditor encountered other issues:
 - Problems in bookkeeping regarding accounts payable and errors in payroll
 - Poor inventory control including poor timing of inventory in relation to seasonal fluctuations.
 - Excess Inventory during slow season results in tying up cash that can be better used elsewhere.
 - Insufficient inventory during busy season leading to delays in deliveries to customers or possible loss of customers.
- Once these issues were cleared up the decision was to do another random sampling for building a forecasting model but this time using 3% precision

Same Sample Now Used for Forecasting

Using standard Excel Methods

(Auditmetrics Pro V7 this step is now automated)

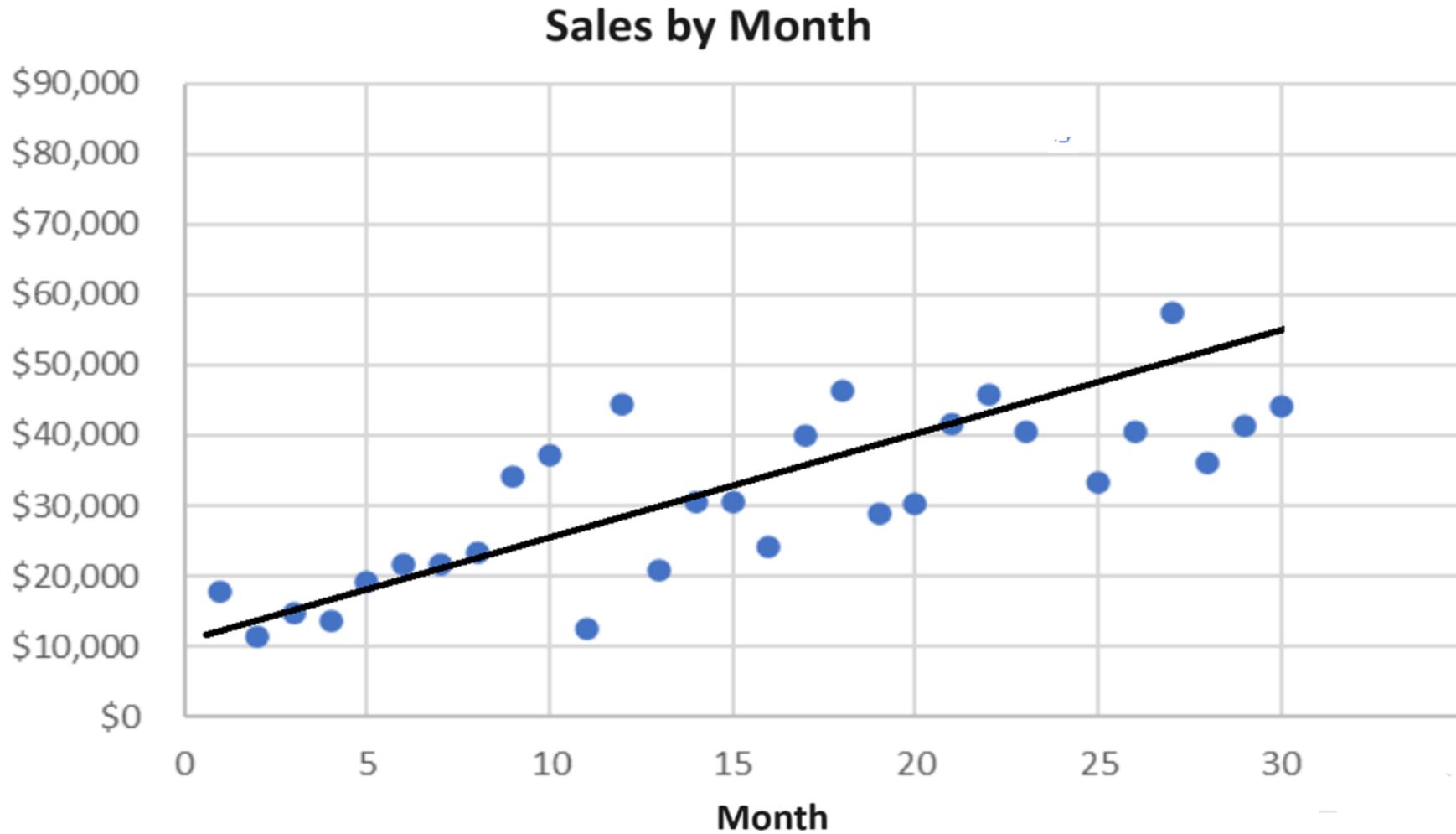
amount	absamt	TxDate	DataSet	Year	Month	Quarter	MonthCount	MonthTotal
-920	920	1/31/2019	Acme Inc.	2019	1	1	1	\$18,407
2107.99	2107.99	2/12/2019	Acme Inc.	2019	2	1	2	\$17,408
2000	2000	3/22/2019	Acme Inc.	2019	3	1	3	\$21,489
2047.9	2047.9	4/19/2019	Acme Inc.	2019	4	2	4	\$24,240
2045.04	2045.04	5/13/2019	Acme Inc.	2019	5	2	5	\$22,940
"	"	"	"	"	"	"	"	"
2400	2400	8/13/2019	Acme Inc.	2019	8	3	8	\$29,100
2302.84	2302.84	2/9/2021	Acme Inc.	2021	2	1	26	\$66,982
2381.32	2381.32	3/26/2021	Acme Inc.	2021	3	1	27	\$65,610
2250	2250	4/7/2021	Acme Inc.	2021	4	2	28	\$35,279
2403.32	2403.32	5/21/2021	Acme Inc.	2021	5	2	29	\$52,524
2229	2229	6/19/2021	Acme Inc.	2021	6	2	30	\$54,450

Regression Prediction Model Using Excel

REGRESSION SUMMARY OUTPUT					
Regression Statistics		1. Two and a half years of sales data			
Multiple R	0.70	2. Sample Size n =1,158			
R Square	0.49	3. Derived from an account of over 22,000 records			
Standard Error	13022	4. Monthly Sales = \$19,056 + \$1,439 x MonthCount			
Observations	30				
ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	4652827901	4652827901	27.4	0.0000
Residual	28	4747670722	169559669		
Total	29	9400498623			
	Coefficients	Standard Error	t Stat	P-value	
Intercept	19056	4876.2	3.91	0.00054	
MonthCoun	1439	274.7	5.24	0.00001	

Regression Summary

Sales by Month



FROM AUDIT TO FORECASTING

1. The data conversion from audit to regression uncovered a business with a healthy growth rate.
2. Next quarterly projections can be compared to what actually unfolds.
3. Any significant deviation from the trend should be carefully investigated.
4. Model can be augmented with other data to analyze customer satisfaction and basic market research.
5. One cannot do this broad systematic analysis without also being closely connected to the personnel and operations of the business.

Allowing for Seasonal Fluctuations

Though there was a very good fit, there is a problem with the model so far:

- Data is that of a wholesaler that supplies retail outlets.
- A prediction for the next month or quarter will always be higher than the previous month or quarter.
- But business activity does have seasonal fluctuations.
- The fourth quarter of the year with its holiday activity will always be higher than the following first quarter of the next year.

Use sample to select customers to start market research

Springer Pg 79 - 86

Rec_Count	VENDOR_NUMBER	amount	absamt	TxDate	DataSet	ZipCode	Customer ID	Strata	Use Excel Modulus Skip Function
1	555	\$5.13	\$5.13	12/1/2019	Acme Inc	20137	15550	1	Uses Rec_Count and Excel Mod Function
2	666	\$5.16	\$5.16	5/1/2019	Acme Inc	20134	16660	1	
3	555	\$5.25	\$5.25	9/1/2019	Acme Inc	20134	15550	1	
4	555	\$5.80	\$5.80	3/1/2019	Acme Inc	20136	15550	1	
5	680	\$6.30	\$6.30	7/1/2020	Acme Inc	20134	16800	1	
6	555	\$7.93	\$7.93	12/1/2020	Acme Inc	20134	15550	1	
7	412	\$8.00	\$8.00	1/1/2021	Acme Inc	20135	14120	1	
8	555	\$8.00	\$8.00	3/1/2021	Acme Inc	20135	15550	1	
9	3236	\$8.25	\$8.25	7/1/2019	Acme Inc	20137	42360	1	
10	2014	\$8.50	\$8.50	11/1/2019	Acme Inc	20137	30140	1	
11	412	\$8.75	\$8.75	7/1/2020	Acme Inc	20136	14120	1	
12	412	\$8.95	\$8.95	5/1/2020	Acme Inc	20136	14120	1	
13	680	\$9.70	\$9.70	10/1/2019	Acme Inc	20137	16800	1	
14	586	\$11.00	\$11.00	7/1/2019	Acme Inc	20134	15860	1	
15	1574	\$11.32	\$11.32	3/1/2020	Acme Inc	20136	25740	1	
16	680	\$11.50	\$11.50	5/1/2021	Acme Inc	20136	16800	1	
17	555	\$11.90	\$11.90	5/1/2021	Acme Inc	20134	15550	1	
18	555	\$12.25	\$12.25	10/1/2019	Acme Inc	20136	15550	1	
19	2869	\$12.57	\$12.57	6/1/2020	Acme Inc	20136	38690	1	
20	2698	\$12.91	\$12.91	6/1/2019	Acme Inc	20134	36980	1	
21	555	\$13.24	\$13.24	5/1/2021	Acme Inc	20136	15550	1	
22	1461	\$14.27	\$14.27	3/1/2020	Acme Inc	20137	24610	1	
23	555	\$15.24	\$15.24	3/1/2021	Acme Inc	20135	15550	1	
24	2014	\$15.75	\$15.75	3/1/2020	Acme Inc	20135	30140	1	
25	593	\$16.47	\$16.47	12/1/2020	Acme Inc	20137	15930	1	
26	631	(\$17.67)	\$17.67	11/1/2020	Acme Inc	20134	16310	1	
27	412	\$18.60	\$18.60	7/1/2020	Acme Inc	20136	14120	1	
28	555	\$18.75	\$18.75	6/1/2020	Acme Inc	20136	15550	1	
29	3474	\$20.10	\$20.10	10/1/2019	Acme Inc	20136	44740	1	
30	1574	\$20.89	\$20.89	1/1/2019	Acme Inc	20134	25740	1	

The process displayed is to select a subset of every tenth transaction for customer feed back.

This is a quick and easy way to select customers for an opinion survey or focus group.

It is not a random sample of customers but a random sample of different levels of sales and then link that level to a customer.

It is a quick and easy way to get immediate feedback. The Springer book has a more detailed discussion of the issue of market research

Using Regression to Measure Demographics of Customer Base

- Below is a data set that incorporates geographic areas based on zip codes:

Zip_Code	Zip_Area	Sales
0017	1	3,102
0016	1	6,658
0008	1	6,514
0012	1	10,000
0007	1	6,000
0005	1	9,634
0011	1	12,666
0003	2	35,548
0006	2	40,508
0020	2	60,074
"	"	"

The Regression line results:

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	-\$30,885	\$6,135	-5.0	0000
Zip_Area	\$47,049	\$2,540	18.5	.0000

Local Market Area Using Excel Pivot Table

- Sales = $-\$30,885 + \$47,049 \times \text{Zip Area}$

Area	Sum of Sales
Zip Area 1	\$185,228
Zip Area 2	\$446,808
Zip Area 3	\$608,160
Zip Area 4	\$602,265
Grand Total	\$1,842,461

Local Area Market Research

- **Step 1 Characteristics of Market Area**

- Regression is very valuable in adjusting predictions using categorical adjustments for various demographics such as geographic region, gender and other demographic factors.
- Geographic region can also be a surrogate for income distribution which is readily available from government published data.
- For example, there is available through government sources income tax collections by zip code.
- Such data combined with census population data by zip can be a surrogate for socio economic characteristics.
- With a little care many other indicators of socioeconomic significance can be collected.
- This is where more general-purpose AI can be very useful in mounting a marketing campaign

- **Step 2 Create a Profile of the Customer Base Using Likert scales or focus groups**

- What age are they?
- What is their income level?
- What is their education level?
- What kind of jobs do they have?
- What is their perception of your company?
- How do they rate your service?

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