And Auditing, Forecasting, and Market Research*

How They Work Together

The triad of auditing, forecasting and market research are usually thought of as only attainable using sophisticated AI software algorithms and technology. The goal of Auditmetrics is to show that data science does not start with technology but how one approaches business data analytics with an understanding of the fundamental principles of statistical analysis.

Auditing, Forecasting, and Market Research
three components are interconnected in several ways:

1. **Data Integrity:** Auditing ensures that the data used in forecasting is accurate and reliable. By verifying the quality of data sources through audits, organizations can improve the accuracy of their forecasts. For instance, if an audit reveals inconsistencies in the administration of sales data collection methods, adjustments can be made to enhance future forecasting efforts.

2. **Revenue Trends:** Forecasting helps managers guide strategy and make informed decisions about critical business operations such as sales, expenses, revenue, and resource allocation. Forecasting adds a competitive advantage and can be the difference between successful and unsuccessful outcomes. Another benefit is that financial institutions will not put money in a business if it's unable to provide a set of thoughtful forecasts. Financial forecasts will also help develop operational and staffing plans that will make a business more efficient.

3. **Informed Decision Making:** Market research provides valuable insights that can guide both auditing processes and forecasting models. By understanding consumer behavior and market dynamics through research, organizations can set realistic goals during audits and create more accurate forecasts that reflect current market conditions.

4. **Continuous Improvement:** The feedback loop created by these three components fosters continuous improvement. Audits can identify gaps that can impact forecasting accuracy and impede meaningful market research methodologies. The audit corrects latent data issue which can lead to improved forecasting techniques which in turn can lead to better-informed market research initiatives that align with organizational goals.

**This Exercise is geared for the small business/Learning version. There is an adage that the best approach to move forward is to "see one, do one, teach one". This exercise is to accomplish the first two. With the download of AuditmetricsAI Pro, in addition to expanded features, is the availability of PowerPoint slides and other education materials.*

The beta version AI upgrade for Pro 6.6 will soon be released for distribution. We will announce here soon.

Bringing it Together

In this section we will go over the transition from auditing to forecasting using a sample created by AuditmetricsAI software. Springer book page references are inserted.

1. Data Integrity

The audit is the starting point to assure that cashflow is performing with efficiency. A random sample is of upmost importance in conducting a valid audit. We will not go into detail on this step. That is better handled in the ***"Getting Started" documentation.***

Suppose a fiscal manager wants to do an audit of a sales account with a million transactions. The AI process guides the manager to obtain an Excel statistical sample that can vary from 400 to 1000 records depending on the chosen precision, or as the pollsters term it "margin of error". The AI process conforms to AICPA and IRS standards.

It would be valuable to review the case study on (*pp.13-22,28,29)* Statistical efficiency has a major impact on sample size and cost effectiveness. Spending time to understand statistical efficiency is well worth the effort *(pp. 25,36,37,41-45,127)*. It is the pervasive underlying corner stone of all statistical inference processes for such diverse disciplines as medicine, economics, physics, biology, opinion polling and social sciences. Take the time to understand it rather than pass it on to AI alone to do the thinking.

2. Revenue Trends

Transition data from audit to Forecast

Table 1 – Auditmetrics generated Random Sample that was used for an audit

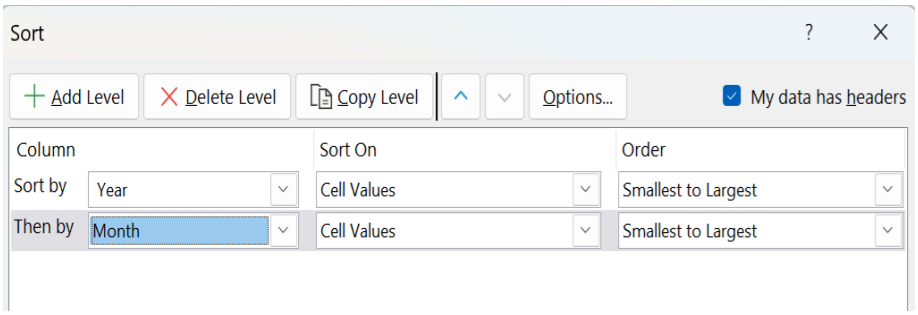
	A	B	C	D	E	F
1	**Transaction_ID**	**Revenue**	**TxDate**	**Strata**	**Year**	**Month**
2	3505	$18.22	1/1/2022	1	2022	1
3	3451	$79.02	1/1/2022	2	2022	1
4	15818	$92.42	1/1/2022	2	2022	1
5	14484	$180.00	1/1/2022	3	2022	1
6	18375	$189.94	1/1/2022	3	2022	1
7	3558	$260.00	1/1/2022	3	2022	1
8	11679	$384.00	1/1/2022	3	2022	1
9	14554	$403.77	1/1/2022	4	2022	1
10	"	"	"	"	"	"
	"	"	"	"	"	"
25	25427	$2,087.09	6/1/2024	6	2024	6
26	24146	$2,100.00	6/1/2024	6	2024	6
27	15380	$2,130.84	6/1/2024	6	2024	6
28	3191	$2,150.00	6/1/2024	6	2024	6
29	11587	$2,160.00	6/1/2024	6	2024	6
30	24154	$2,229.00	6/1/2024	6	2024	6
	3314	$2,422.00	6/1/2024	6	2024	6

Table 1 is a condensed exhibit of the sample (n= 1,158) using a 3% margin of error. In preparing the sample for forecasting, two new variables are added. In the first row the new cells are:

Year - Excel function: =**Year**(*C2)*

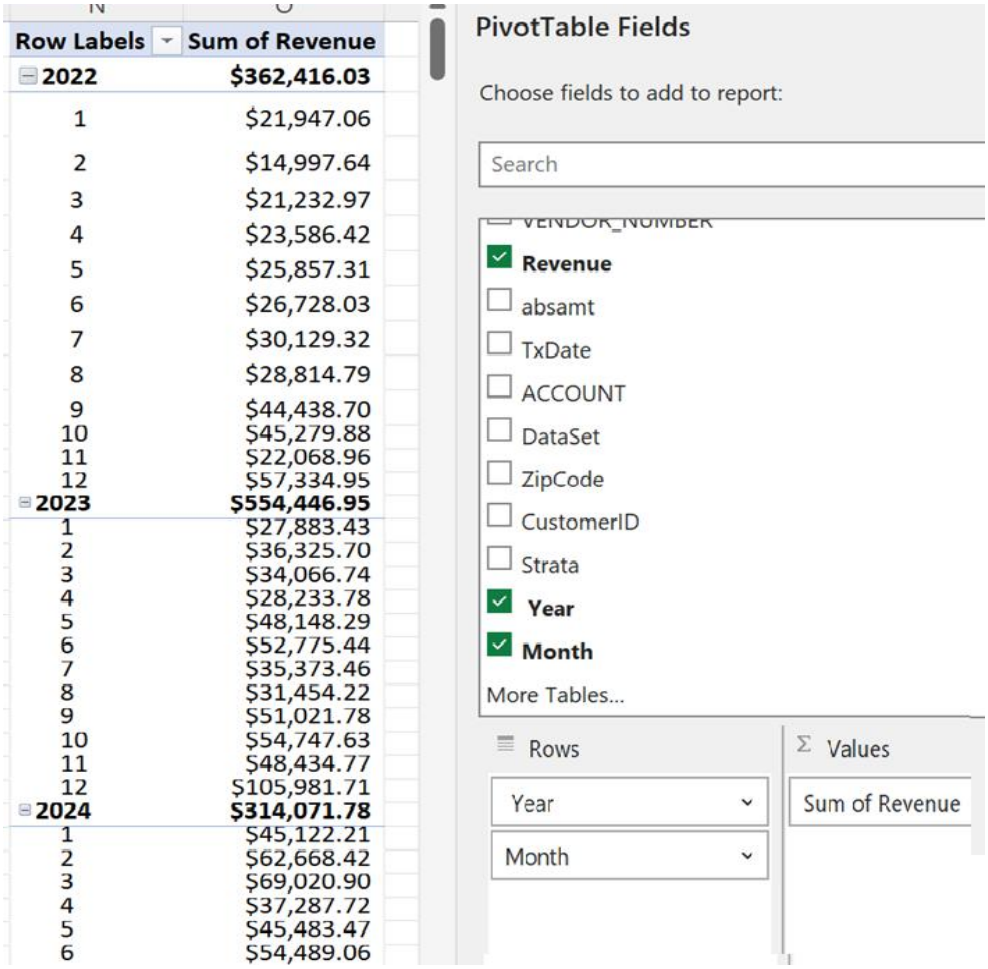
Month- Excel function: =**Month**(C2)

The Excel sample represents 30 months of data over a 2 ½ year period. First sort by Year and Month. Go to "Data" on Excel's top menu and then select "Sort". In the following exhibit are the sort inputs:



The next step is to create a summary dataset that lists total revenue by month for the 2 ½ years. The Excel tool is the Pivot Table. Select the dataset of interest and then select insert and then Pivot Table.

Figure 1- The pivot table set up and results



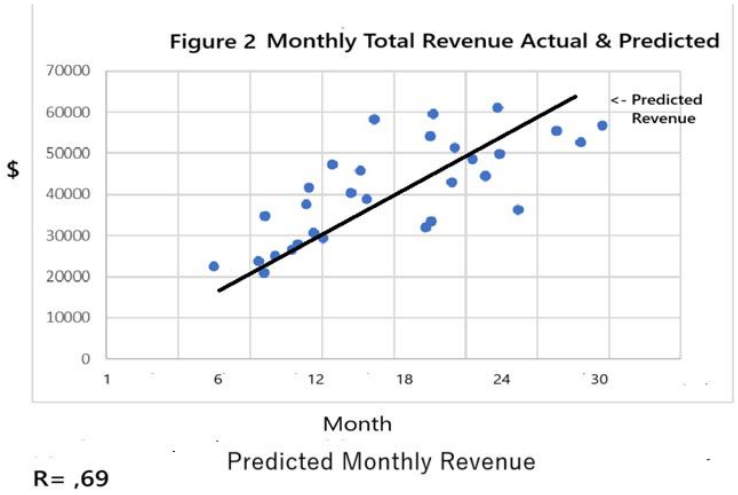
Row Labels	Sum of Revenue
2022	$362,416.03
1	$21,947.06
2	$14,997.64
3	$21,232.97
4	$23,586.42
5	$25,857.31
6	$26,728.03
7	$30,129.32
8	$28,814.79
9	$44,438.70
10	$45,279.88
11	$22,068.96
12	$57,334.95
2023	$554,446.95
1	$27,883.43
2	$36,325.70
3	$34,066.74
4	$28,233.78
5	$48,148.29
6	$52,775.44
7	$35,373.46
8	$31,454.22
9	$51,021.78
10	$54,747.63
11	$48,434.77
12	$105,981.71
2024	$314,071.78
1	$45,122.21
2	$62,668.42
3	$69,020.90
4	$37,287.72
5	$45,483.47
6	$54,489.06

The resulting data table can now be used for a thirty month forecast of future revenue. Table 2 is a restructuring of the data to use regression analysis to create a prediction model *(pp.60-67)*.

Table 2 – Dataset for Regression Predictions

Month	Revenue	Month_ Count
1	**$21,947**	**1**
2	**$14,998**	**2**
3	**$21,233**	**3**
4	**$23,586**	**4**
5	**$25,857**	**5**
6	**$26,728**	**6**
7	**$30,129**	**7**
8	**$28,815**	**8**
"	"	"
1	**$45,122**	**25**
2	**$62,668**	**26**
3	**$69,021**	**27**
4	**$37,288**	**28**
5	**$45,483**	**29**
6	**$54,489**	**30**

What is added is a new variable "Month_Count". It is used to measures changes in revenue as we go from Month 1 to month 30. You can see from figure 2 that revenue increases as we go from the first month to last month in our series.



Monthly Sales =$19,350 + ($1,412 x Month_Count)

A full discussion of regression modeling is in Springer Appendix I (*pp. 107-111)*. The details of how to use Excel's ToolPak for Regression is on (*pp. 60-67).*

Unfortunately, this regression model is not complete. So far, the basic model is a bivariate linear model, a dependent variable with only one predictor variable. Though we have a very good fit, there is a problem with the model.

The data is that of a wholesaler that supplies retail outlets. With this prediction model the next month will always be higher than the previous month. But business activity does have seasonal fluctuations. The fourth quarter of the year and its increased commercial activity will always be higher than the first quarter of the following year. The model as it exists does not allow for seasonal fluctuations.

We need a new multiple regression model with two predictor variables to quarterly adjust the monthly model. It is a statistical technique that uses several explanatory variables to predict the outcome of the sales dependent variable. In essence, multiple regression is an extension of our current regression model sometimes referred to as bivariate regression. Multiple regression involves more than one explanatory variable. To the new forecasting model are added quarterly variable inputs to the pivot table. The model will now conduct forecasts that adjust for seasonal fluctuations.

Table 5 – Quarterly Variable Added

Month	Revenue	Month_ Count	Quarter
1	$21,947	1	**1**
2	$14,998	2	**1**
3	$21,233	3	**1**
4	$23,586	4	**2**
"	"	"	"
1	$45,122	25	**1**
2	$62,668	26	**1**
3	$69,021	27	**1**
4	$37,288	28	**2**
5	$45,483	29	**2**
6	$54,489	30	**2**

Table 5 indicates the quarterly value for each month. Jan Feb March are the first quarter of the year. Month 4 or April starts the second quarter.

The multiple regression dataset below takes into account seasonal fluctuations.

Table 6 – First Year Dataset with Quarterly Variables

Month	Revenue	Month_ Count	Quarter	Q1	Q2	Q3
1	$21,947	1	1	1	0	0
2	$14,998	2	1	1	0	0
3	$21,233	3	1	1	0	0
4	$23,586	4	2	0	1	0
5	$25,857	5	2	0	1	0
6	$26,728	6	2	0	1	0
7	$30,129	7	3	0	0	1
8	$28,815	8	3	0	0	1
9	$44,439	9	3	0	0	1
10	$45,280	10	4	0	0	0
11	$22,069	11	4	0	0	0
12	$57,335	12	4	0	0	0

The rationale and details of introducing quarterly adjustment inputs, sometimes called dummy variables, (Q1, Q2, Q3) is on pp 64-67 in the Springer Book.

The model as reported by Excel's toolpak regression analysis is:

	Coefficients
Intercept	28404.26
Month_ Count	1210.023
Q1	-8315.13
Q2	-10909.1
Q3	-8472.54

This model has a correlation of **R =.78** which is a marked improvement of the previous model's value of .69. It would be very useful to review again *Appendix I (pp 107-111)* regarding the concept of goodness of fit of the model.

The following discussion is excerpted from the Springer book. It deals with some methods of market research that can be readily implemented by small businesses.

3. Informed Decision Making

Regression and Local Market Area -Regression *(pp. 79-86)* is very valuable in adjusting predictions using categorical inputs for various demographics factors such as geographic region and gender. Geographic region can also be a surrogate for income distribution which is readily available from government published data. For example, there is available, through census data, sources that break down income tax collections or median income by zip code. Such geographic data based on zip code combined with company sales data can be an indicator of the socioeconomic characteristics of a business' customer base. The compilation of this type of socioeconomic dataset requires time, but gaining insight of the customer base is invaluable. The first step is to set up a dataset of sales accounts that include customer zip code.

The first step is to group the diverse array zip codes into broader more manageable zip code areas. This is where background research of examining census data to develop sociodemographic relevant zip code areas (Table 8.1).

Table 8.1 sales and sociodemographic research resulted in condensing the data into four geographic areas. This number was chosen to simplify the presentation of the concept of using regression to project sales by geographic area. It is most likely that many more areas would be of value, especially for larger businesses. From a statistical data perspective. Zip codes are categorical or classification data.

Table 8.1 Sales Data by Zip Code and by Four Geographic Areas

Zip_Code	Zip_Area	Sales
0017	1	3,102
0016	1	6,658
0008	3	6,514
0012	4	10,000
0007	3	6,000
0005	3	9,634
0011	4	12,666
0003	3	35,548
0006	3	40,508
0020	4	60,074
"	"	"

Regression results:

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	**-30,885**	$6,135	-5	0
Zip_Area	**$47,049**	$2,540	18.5	0

R=.86

R^2=.74 goodness of fit measure. 74% of this company sales are explained by geographic area (p.62).

Quite a sizable difference.

Sales = -**$30**,**885** + **$47**,**049** x **Zip** (Geographic Area number**)**

Pivot table to summarize sales by zip code 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**

Determining how to group zip code requires a certain amount of insight and ingenuity. Examining government census, chamber of commerce and other data are great sources. In the era of AI, the available tools are growing exponentially. ***However, the goal of Auditmetrics is that the human business manager intellectually controls the analytic process rather than rely totally on AI.***

As part of business forecasting, it is key to get a picture of the possibilities for selling products or services in a local market. Looking at local markets will provide information about the types of individuals who might buy products or services and how extensive is the company's geographic reach. Also, it may indicate what is the competition within the various market areas.

Create a Customer Profile Next there is a need to determine who are the people who will buy products or services.

at what age are they?

What is their income level?

What is their education level?

What kind of jobs do they have?

What do they like to do for entertainment?

It may be too cumbersome and difficult for a small business to survey for such data. But a small demographically diverse focus group is a proven way to measure customer opinions. It is set up in guided or open discussions about new products or current views of the company to determine reactions that can be expected from a larger population. The use of focus groups is a market research method that is intended to collect data through interactive and directed discussions by an experienced interviewer. If there are issues with lagging sales that don't respond to standard means of marketing, then arranging for a focus group may be what is needed.

Springer book pp. 81-86 discusses how to coordinate opinion Likert data with regression projections.

Constant Monitoring of Business Activities

Regular timely random samples allow the business manager to deal with small workable subsets of account data representative of the total book. There is no need to use the gold standard of 3% margin of error with its sample size of 1,152. It should be reserved for official filings such as for tax agencies or fiscal year end assessments and reporting.

Regular routine smaller samples in the 5% to 7% range can involve samples approximately 40% to 50% smaller, therefore resulting in reduced cost. The statistical efficiency of using regular, timely small samples can be quite significant, especially when employing robust statistical methods:

1. **Increased Precision:** Small samples can provide precise estimates if the sampling method is consistent and well designed.

2. **Sequential Testing:** Regularly updating with small sample sizes allows for sequential testing of new ideas and data, which can improve business performance over time.

Total Process Overview The overall process in conducting forecasting and market research is to:

1. *Start with a random sample of accounts.*
2. *From there use regression to project revenue and expenses.*
3. *Also add to the account data pertinent variables such as geographic and socio-demographic data.*
4. *Set up a mechanism to obtain customer ratings using Likert scales.*
5. *The total process from audit to market research cannot be done without also being closely connected to the personnel and operations of the business. The major benefit is creating an environment leading to technology and employee cohesion*.

Conclusion: A Synergistic Approach

In conclusion, auditing, forecasting, and market research work together synergistically to enhance organizational effectiveness. Ensuring data integrity through audits leads to confidence in the insights from forecasts and market research. informed decision-making results in utilizing accurate forecasts for strategic planning. As a result businesses can achieve greater success in their operations.

Auditmetrics Public Health Publication

Value Added in Healthcare and Public Health

Value added is the extra value created over and above the original value of something

- For private business it is usually the products sold to the consumer
- It is the difference between a product final selling price and the direct and indirect expenses incurred in providing that product

In healthcare and public health, the challenge is how to measure value added

- Research into organizations that have achieved better health outcomes while often lowering costs suggests a strategic framework for value-based public health and healthcare implementation

- Focusing on health outcomes aligns how patients experience their health with links to the investment incurred

- This is the basis of cost effectiveness and cost benefit analysis of public health and healthcare programs

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