

Section 6—Adjustment for change

Purpose

Market conditions may create the need for an adjustment to sales prices that occurred during the sales year to January 1 of the year following sales data collection. Time itself is not the cause for the adjustment; it is the movement of value over time. The adjustment change is expressed as a percentage of increase or decrease to sales prices to reflect what the property would have sold for as of the assessment date. If market conditions have not changed, no adjustment is required, although a considerable amount of time may have passed.

Change adjustments are used to adjust the individual sale prices to reflect market conditions on the assessment date. In addition, change adjustments are used when sales outside the current sales year are used to supplement insufficient sales sampling for ratio analysis. These additional sales are combined with current sales for a supplemental study. In the ratio study, change adjustments (or no change adjustments) must be supported by analysis.

Types of trends

Recognizing that more than one type of change trend exists will provide a better understanding of the conclusions developed by the ratio study process.

Trends can be defined as a statistically detectable change in value over time due to the actions of buyers and sellers in the market place. There are many types of change-related trends. The analyst must recognize the correct trend for the current purpose. These trends may be local, regional, and/or nation/world wide. Some of the more familiar trends include:

Economic trend

A general, all-encompassing trend logically based on economic factors.

Cost trend

The rate of change in construction costs.

Market trend

A market trend is the rate of change of market prices for specific classes of properties, such as multi-family residential, commercial, etc. Market trends are often set by or follow local, statewide, or regional economics. These

trends can often be delineated along market areas and should be measured by market area.

Long-term trend

A long-term trend is the rate of change over a number of years. Some industries such as housing or wood products experience dynamics that may or may not change rapidly and are cyclical in nature. These industry-wide changes may reflect changes in supply (resource shortage) and demand (demographic change).

Annual trend

An annual trend is the rate of change from one year to the next or any 12-month period.

Seasonal trend

A seasonal trend is the rate of change over a few specific months. This would also include winter use areas, summer use areas, financial reporting quarterly periods, etc.

Seasonal variation

The seasonal variation is a consistent relationship between an annual trend and a seasonal trend.

Short-term trend

Rate of change calculated over a few months or weeks. This may be used to determine the direction of the market at a point in time.

Change trend analysis

Change trends are developed by grouping sales ratios by month and/or quarter and are summarized in sales ratio listings. These ratios can be graphed to determine change trends. A change adjustment developed using a ratio trend is usually accurate if there are an adequate number of sales per analysis period (month or quarter). This number may vary depending on the population size of the area you are measuring. Statistically, 20 sales per period have been used as an acceptable guide. However, many counties will fall short of this number on a continuous basis. Caution, judgment, and supplemental information need to be utilized when creating change adjustments with limited sales data.

Adjustment for time

A useful tool for determining ratio trends is a scatter diagram. (See example on page 6-7.) A common method of graphing is to use the ratio of sales price to real market value against the date of sale. Using this inverse of the conventional sales ratio is beneficial because it makes the graph more readable for the user. An upward trend in the ratios tends to indicate inflation, while a downward trend indicates deflation.

A useful adjunct to this analysis is regression analysis, which helps to quantify the rate of change. Some statistical computer programs provide a **curvilinear** regression analysis facility to better recognize trends **by period** within a year, such as: monthly, quarterly, semi-annually, or in multiples of years, annually, bi-annually, etc.

Methods of change adjustment

Three methods for change adjustment are:

I. Ratio trend analysis.

- Adjusting individual sales.
- Adjusting the selected ratio.

II. Regression analysis.

- Linear.
- Curvilinear.

III. Double sales analysis.

I. Ratio trend analysis

Adjusting individual sales

First, a change adjustment expressed as a percentage needs to be established. Depending upon the amount of data available, an adjustment can be established by month

or by quarter. The change adjustment can be determined countywide by property class or by market area by property class.

A graph is an excellent analysis tool to display your data, providing you with a visual projection of the data and the market-related conditions. The Trend Line Chart on page 6-8 is an example that has been created for the purpose of this illustration. The graph will be a representation of the increase of 1 percent per month change adjustment mentioned in the following paragraphs.

To compute this adjustment:

1. Plot the ratios by month for the 12-month period.
2. A trend line would be helpful to easily reveal your year-end ratio conclusion.
3. As established in the graph, the year-end ratio conclusion of 89 percent indicates a value increase over the 12-month period of 11 percent.
4. The 89 percent will need to be converted into an adjustment by dividing 89 percent into 100 percent, which will equal to 1.12359 or 12 percent per year or 1 percent per month.

Once a change trend has been established, the percentage per month or quarter can be applied to each sale. Each sale should be trended to the target assessment date of January 1.

For ease of computation, an increase of 1 percent per month change adjustment is used. In the following example, the month sold is the first month counted.

Individual sales adjustment table

RMV Jan-01	Sale price	Ratio	Sale date	# Months to Jan-02	Change adjustment	Trended sale price	Adjusted ratio
\$99,980	\$118,000	85	Nov	2	1.02	\$120,360	83
\$123,640	\$145,000	85	Jun	7	1.07	\$155,150	80
\$89,090	\$89,900	99	Dec	1	1.01	\$90,799	98
\$116,730	\$115,500	101	Aug	5	1.05	\$121,275	96
\$120,710	\$118,000	102	May	8	1.08	\$127,440	95
\$97,420	\$95,000	103	Apr	9	1.09	\$103,550	94
\$250,720	\$235,000	107	May	8	1.08	\$253,800	99
\$140,520	\$130,500	108	Jul	6	1.06	\$138,330	102
\$172,540	\$159,900	108	Dec	1	1.01	\$161,499	107
\$111,120	\$100,450	111	Jan	12	1.12	\$112,504	99
\$1,322,470	\$1,307,250					\$1,384,707	952

Central tendencies **before** adjustment Central tendencies **after** adjustment

Mean	101	Mean	95
Median	102	Median	97
Weighted Mean	101	Weighted Mean	96

Note: The after-change adjustment ratios are not in ascending order. They will need to be re-sorted to provide a new array.

Adjusting the selected ratio

With this approach, the selected ratios of the same property class (types) in various market areas may have the change adjustment factor applied to achieve the proper ratio for the next January 1 assessment date. Sufficient sales are needed for this method to be useful.

To compute this adjustment:

- Graph the ratios by month of sale or by quarter if enough data is not available by month. A trend-line needs to be computed from this graph. See the following Trend Line Chart.
 - Determine the central tendency of the sales sample by month.
- Determine the mid-point of the sales year. The mid-point is the ratio that most accurately represents the majority of the sales activity during the ratio year. This is not necessarily the middle of the year. An example of how to determine the mid-point follows.

Mid-point ratio table

	Ratio indication for the month	Number of sales per month	Cumulative sales
January	99	195	195
February	97	176	371
March	97	215	586
April	96	174	760
May	94	298	1,058
June	95	316	1,374
July	93	293	1,667*
August	93	305	1,972
September	91	274	2,246
October	92	303	2,549
November	91	265	2,814
December	91	236	3,050

* July represents the middle of the sales year in this example.

Using this example: To find the simple average, divide total sales (3,050) by 2.

$$3,050 \div 2 = 1,525$$

Adjustment for time

To find the mid-point ratio, find the closest number (and corresponding month) in the array.

3. Compute the percent change from the mid-point ratio on the trend line to the next January 1 ratio on the trend line. For example, using the trend line per the following graphs (see midpoint ratio chart on page 6-9):

- The central tendency on the trend line is the July ratio (93) and the next January 1 ratio (91).
- To compute the percent change from the mid-point on the trend line to next January 1, calculate as follows:

1. January 1 trend line ratio (91) minus mid-point trend line ratio (93) divided by the mid-point trend line ratio (93) equals the trend.

$$(91-93) \div 93 = -0.022 \text{ or } -2\%$$

2. Subtract the -2 percent from 100 percent to get the change trend adjustment factor (multiplier) of 0.98 or 98 percent.

If positive adjustment (number) add to 100

If negative number, subtract from 100, as a reciprocal.

3. **Example:** Using the selected ratio from individual sales adjustment table "Central Tendency Before Adjustment," multiply by 98 percent or 0.98 to reflect the change to January 1.

4. For this example, use the "Central Tendency Before Adjustment" table's mean ratio of 101 percent as the selected ratio.

5. 101×0.98 (change adjustment factor) = 99 (change adjusted selected ratio)

Note: 99 is in line with the Central Tendencies when monthly change adjustments were applied to each sale in the Individual Sales Adjustment Table.

If sales data are insufficient to establish a trend, use the selected ratio from the array for the January 1 trended ratio.

II. Regression analysis

Regression is a technique that tries to define the relationship between the two variables time and change. It is an attempt to express the relationship between the variables as a mathematical formula. Once the formula is determined, other convergences of time and change can be predicted. Also, the rate of change over time can

be estimated. The trick is not only determining the type of relationship that best fits the data, but determining how well the relationship fits the data.

Linear regression

An effective method of adjusting for change involves linear regression. It must be emphasized that this method assumes that property values change by a constant percentage each month. This method may be viable for a relatively short period of time, such as a ratio year. Over longer periods of time, or in a rapidly changing or unusual market, it may be necessary to use nonlinear adjustment factors.

Note: Some software programs use the **mean** to make linear regression calculations.

Procedures for applying linear regression for ratio trend lines:

1. **For the population sales array, develop central tendencies per time period (month).** If the sales are scarce, determine your central tendency by quarter (three-month period).
2. **On a graph, plot the central tendency by time period (month).** Let the X-axis be the period and the Y-axis be the central tendency indication.
3. **Connect the dots of the central tendencies with the "best fit" straight line.**
4. **Using linear regression, determine the slope of the line.** The slope of the straight line is the trend of the ratio by the time period as determined in Step 1.

Briefly stated:

If the relationship between two variables (eg., time and sales price) can be expressed as a straight line, the relationship is deemed "linear."

According to *Webster's*, "regression" is defined as "a functional relationship between two or more correlated variables that is often empirically determined from data and is used especially to predict values of one variable when given values of the other(s)."

If we put the two words together, it means that in a straight-line relationship between two variables, we can predict one variable if the other is known. Applying this to the trend of the ratio, we are saying that if we know the time period, we can predict the central tendency by either interpolating within the line or extrapolating from the line.

The formula for a straight line is: $y = ax + b$

In the above formula:

1. **y** is the dependent variable. The value of (**y**) depends on the value of (**x**).
2. **x** is the independent variable. The above formula solves for **y**, not **x**.
3. **b** is the **y** intercept. If **x = 0**, **y** will be that value.
4. **a** is the slope of the line. The slope of the line is also the rate of change of the dependent variable for the indicated unit of **x**.

Using the above formula, we can solve for **y** if we know **x**; or in our case, we can solve for the central tendency if we know the time period. However, we really aren't interested in solving for **y**. What we want to know is the rate of change in **y** for every unit of **x**. In this case, the slope of the line **a** indicates the rate of change in the central tendency, per period.

The inverse relationship exists between the ratios and the sale prices. A **downward** slope would mean that the sale prices are increasing over time. An **upward** slope would mean that the sale prices are decreasing over time.

Spreadsheet programs are available to plot regression lines and slope formulas.

III. Double sale/comparable sales analysis

Another method of determining a change adjustment is by analyzing:

- Properties that have sold twice during a relatively short period of time. Both sales of the same property need to be analyzed to ascertain that they are representative of open market activity and usable for the ratio study (same as assessed).

- Sales of comparable properties. These are properties, not the same, but very similar in all property characteristics (class, age, condition, etc.).

The percentage change is determined by doing the following:

1. Subtract the first sale price (SP1) from the second sale price (SP2) to determine the dollar difference (DD) between the first and second sale.
2. Divide the dollar difference (DD) by the first sale price (SP1) to determine the overall percentage change (OPC).
3. Divide the overall percentage change (OPC) by the time span (TS) to determine the monthly percentage change (MPC).

When computed, this change adjustment can be applied to other sales occurring in the same time period. Following is an example using both a double sale property and sales comparison to determine the monthly change in value.

Assume the following:

1. The assessment date is January 1; the sales year is the prior January 1 through December 31.
2. For the current sales year, property class 4-0-0 only had five sales county wide.
3. During the previous sales year, there were seven confirmed sales that have been adjusted to January 1.
 - One of these properties sold twice during the sales year.
 - Another property is very comparable to a property that sold during the current sales year.

	Sale date	Sale Price (SP)	Time Span (TS)	Dollar Difference (DD) (SP1-SP2)	Overall Percent Change (OPC) (DD÷SP1)	Monthly Percent Change (MPC) (OPC÷TS)
Double sale	5/98 12/98	\$49,500 (1) \$53,600 (2)	7 mo.	\$4,100	8.28	1.18
Sales of comparable properties	5/97 4/98	\$68,900 (1) \$79,500 (2)	11 mo.	\$10,600	15.38	1.39

Adjustment for time

This analysis indicates the prior year sales could be adjusted approximately 1 percent per month to make them comparable to current year sales.

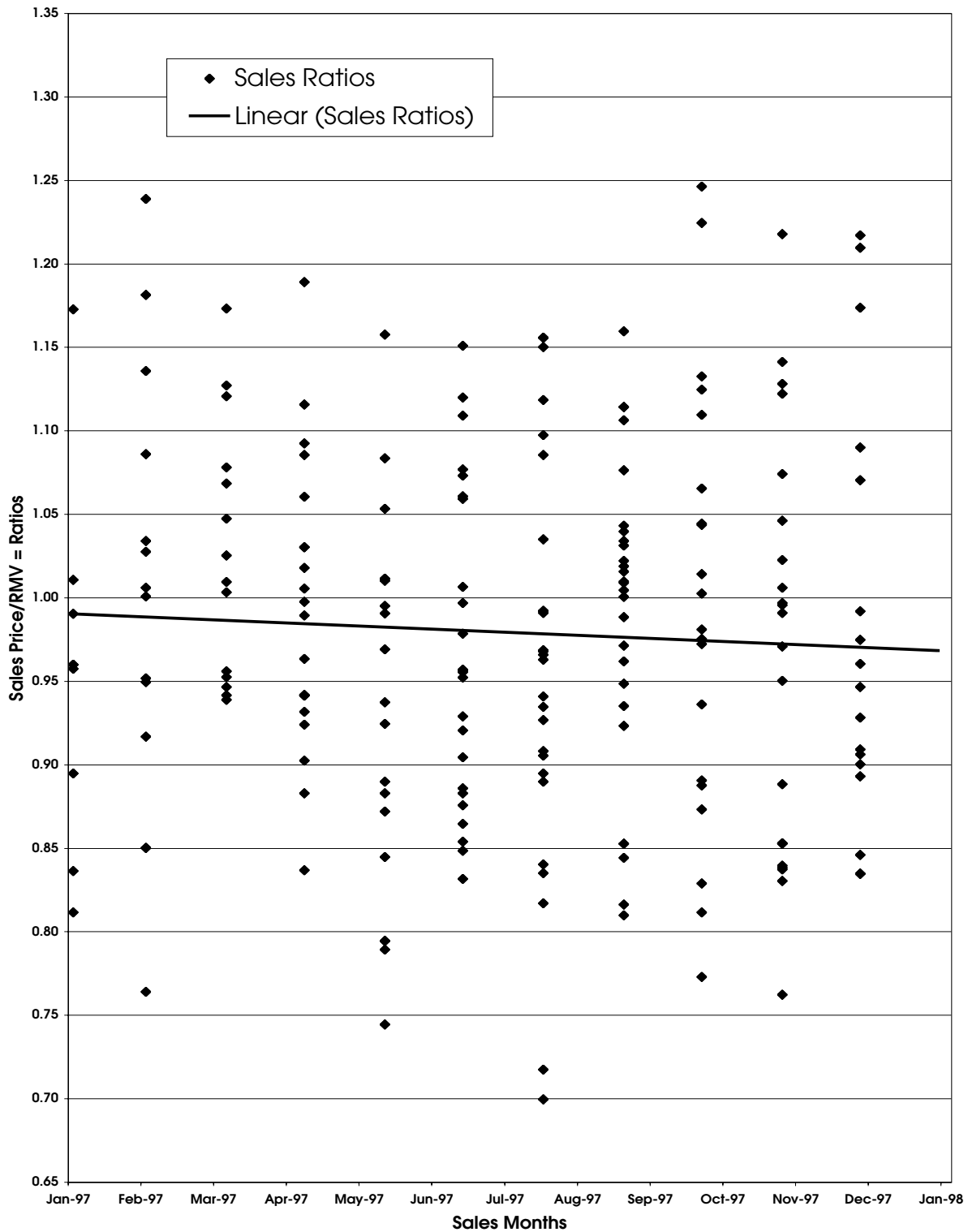
It may be necessary to identify comparable properties that have sold at different points in time and adjust one property to the other for differences in physical characteristics. This method is similar to the method described above, but involves a preliminary step of adjusting the sales price on one property so that both sales prices reflect physically similar properties. The amount of adjustment is determined by a paired sales study or by using the depreciated value of the amenity.

For example, suppose that two homes in a newer tract neighborhood sold within six months of each other. The first sale was for \$112,000, and the second sale was for \$120,000. The homes are very similar except that the second home has an extra garage space, the depreciated value of which is \$2,800; adding the \$2,800 to the sales price of the first home yields an adjusted sales price of \$114,800. These sales are now ready to be used in an analysis as described above.

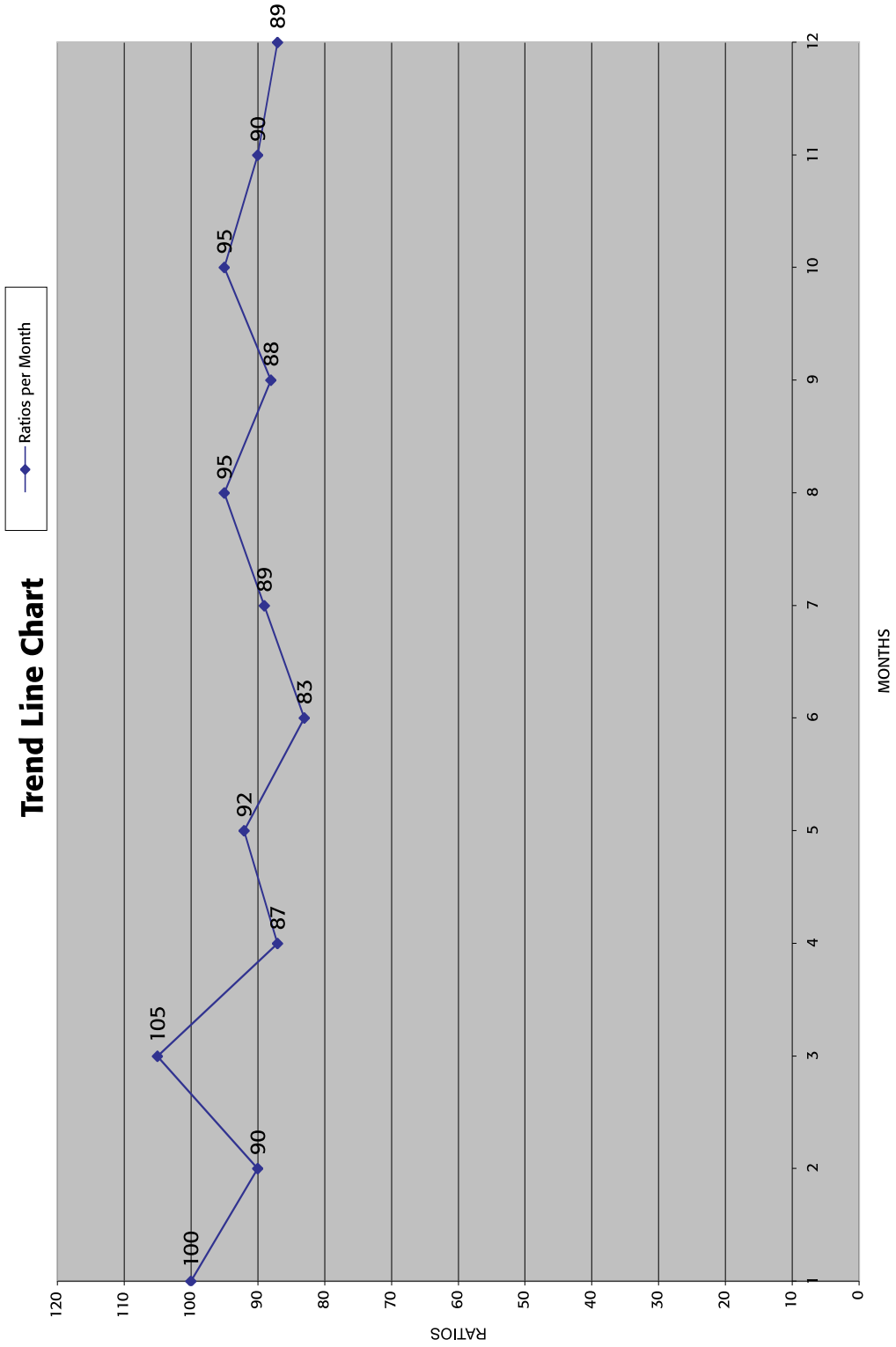
Example graphs on page 6-10:

- Linear Trend line from Monthly Ratios.
- Curvilinear Trend line from Monthly Ratios.
- Seasonal Trend line from Monthly Ratios.

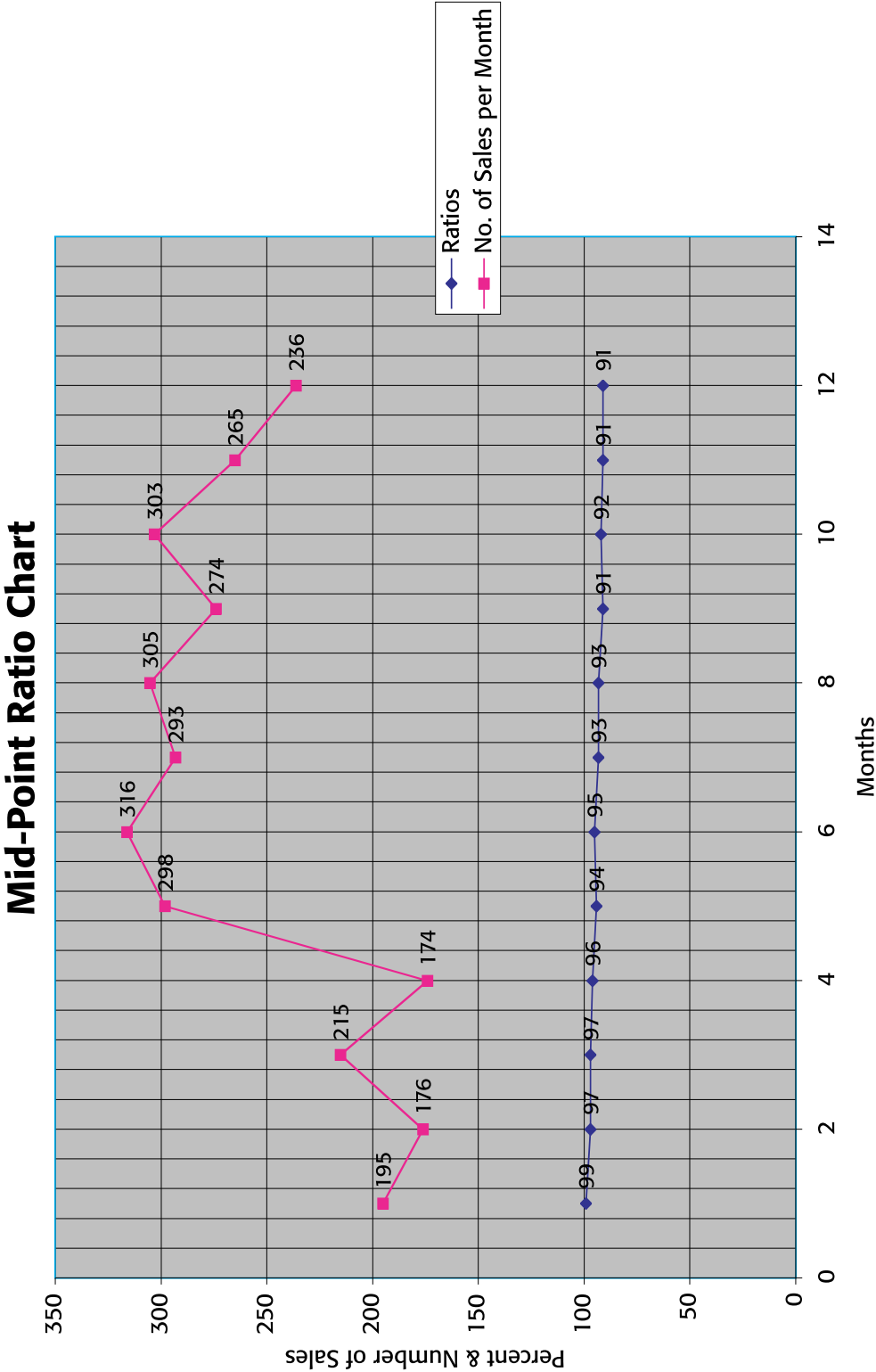
Change Trend From January Through December Scatter, Trend, and Linear Regression Graph



Trend line chart



Mid-point ratio chart



Example graphs

Average month	Ratio
1	99
2	97
3	97
4	96
5	94
6	95
7	93
8	93
9	91
10	92
11	91
12	91

