# INDUSTRIAL GOODS MANUFACTURER'S DATASET

## DETAILS

Estimate the effect of pioneering on market share by using Weighted Least Square model and regression model in SAS.

## Course

Predictive Analytics using SAS

# About the dataset

Industrial goods manufacturers.

| | |
|---|---|
| MS | Relative market share |
| QUAL | Relative quality |
| PRICE | Relative price |
| PLB | Product line width |
| DC | Relative direct costs |
| PION | Whether a firm is a pioneer (1) or not (0) |
| EF | Whether a firm is an early follower (1) or not (0) |
| PHPF | Pioneer *high purchase frequency |
| PLPF | Pioneer *low purchase frequency |
| PSC | Pioneer *seasonal product change |
| PAPC | Pioneer *annual/periodic product change |
| NCOMP | Number of competitors |
| MKTEXP | Relative marketing expenditures (similar to 'relative advertising and promotion') |
| TYRP | Twenty year pioneer |
| PNP | Percentage of new products |
| CUSTTYP | Relative customer type |
| NCUST | Relative Number of customers |
| CUSTSIZE | Relative customer size |
| PENEW | Plant and equipment newness |
| CAP | Capacity utilization |
| RBVI | Relative backward vertical integration |
| EMPRODY | Employee productivity |
| UNION | Percentage of employees unionized |

Please estimate a 2SLS model with the following five equations.

model MS=qual plb price pion ef phpf plpf psc papc ncomp mktexp

model Qual=price dc pion ef tyrp mktexp pnp

model PLB=dc pion tyrp ef pnp custtyp ncust custsize

model Price=ms qual dc pion ef tyrp mktexp pnp

model DC=ms qual pion ef tyrp penew cap rbvi emprody union

a. **Run the 2SLS model using SAS (PROC SYSLIN) and estimate the effect of pioneering on market share. Be sure to consider the direct effects as well as the indirect effects. (read the paper on pioneering advantages for this interpretation).**

| Variable | MS | t Value | qual | t Value | plb | t Value | price | t Value | dc | t Value |
|---|---|---|---|---|---|---|---|---|---|---|
| Intercept | 39.2647 | 0.61 | -263.094 | -4.21 | 109.069 | 66.09 | 100.311 | 109.5 | 1.14227 | 5.17 |
| qual | 0.50851 | 4.13 | | | | | 0.14247 | 4.05 | 0.03526 | 6.76 |
| plb | -1.00932 | -2.44 | | | | | | | | |
| price | 0.88 | 1.31 | 2.57067 | 4.09 | | | | | | |
| pion | 7.17407 | 4.37 | 3.21 | 0.72 | 1.73 | 1.02 | 2.04995 | 1.93 | 0.05 | 0.23 |
| ef | 5.79245 | 3.71 | -2.25 | -1.05 | -0.13 | -0.17 | 0.08 | 0.15 | 0.14 | 1.47 |
| phpf | 0.57 | 0.38 | | | | | | | | |
| plpf | 0.17 | 0.04 | | | | | | | | |
| psc | -30.8936 | -2.39 | | | | | | | | |
| papc | -1.46 | -0.65 | | | | | | | | |
| ncomp | -7.55458 | -15.42 | | | | | | | | |
| mktexp | -0.29 | -1.73 | -0.4787 | -2.36 | | | 0.22504 | 7.33 | | |
| dc | | | 10.5204 | 5.4 | -8.7307 | -3.4 | -0.46 | -0.74 | | |
| ms | | | | | | | -0.02 | -0.95 | 0.005 | 1.33 |
| tyrp | | | -3.63 | -0.87 | -0.31 | -0.2 | -1.83 | -1.89 | 0.09 | 0.52 |
| pnp | | | 0.21001 | 3.4 | 0.05468 | 2.49 | -0.02 | -1.31 | | |
| custtyp | | | | | 3.93967 | 2.88 | | | | |
| ncust | | | | | 0.23 | 1.07 | | | | |
| custsize | | | | | 0.52 | 0.81 | | | | |
| penew | | | | | | | | | -0.003 | -1.65 |
| cap | | | | | | | | | 0.00016 | 0.08 |
| rbvi | | | | | | | | | -0.048 | -0.87 |
| emprody | | | | | | | | | 0.00248 | 2.08 |
| union | | | | | | | | | 0.0015 | 1.56 |

(Note: Fields in yellow are not significant)

**Direct Effect:** Pioneering has a direct effect on market share. Effect of market pioneering on market share is significant as its t-value > 1.96. If a company is a pioneer, then the market share increases by **7.17** units.

**Indirect Effect:**

H1: High product quality increases market share and market pioneering tend to have higher quality

Product quality significantly influences market share (0.51) but marketing pioneering does not have a significant influence on product quality. So higher product quality increases market share by 0.51 points. There is no strong evidence to support H1. Moreover, pioneering doesn't have a direct effect on product quality.

H2: Broader plb increases market share and market pioneering tend to have broader product lines.

Product line breadth has a significant influence on market share (-2.44) but market pioneering does not have significant influence on product line breadth. There is no strong support for H2. Moreover, pioneering doesn't influence product line breadth.

H3: Because of distribution advantages, market pioneering has high market share where product has low price and high purchase frequency and customer service is relatively unimportant.

Pioneer high purchase frequency is insignificant, and both Pioneer low price and low customer service importance are not present in the list of variables. Hence there is no evidence to support H3. So pioneering is not influenced by price, high purchase frequency and customer service.

H4: Market Pioneering have high market share with intensive advertising.

Pioneer intensive advertising (-0.29) is negative and is insignificant. Due to small size of the coefficient estimates and lack of statistical significance, no strong support can be mustered for H4. So, effect of pioneer intensive advertising does not influence market share.

H5: Low prices increases market share and market pioneering charges low prices.

Price has a positive and significant (0.88) impact on market share. In relative price equation, market pioneers charge significantly more (2.05) and is significant. Multiplying these two coefficients yields 1.8 market share points. Since, price has a significant influence on pioneering and so higher the pricing effect of marketing pioneers higher is the market share**. Thus, there is strong evidence to reject H5**.

H6: Based on absolute cost advantages, Marketing Pioneers have direct cost savings. These savings lead to higher marketing mix and market shares.

H7: Based on scale economy advantages, pioneer have direct cost savings which lead to a stronger marketing mix and market shares.

Pioneers are estimated to have insignificant direct cost savings**. Higher market shares lead to significant direct cost savings increase by 0.005 units.** Thus, there is no effect of pioneering on direct costs, however usually market shares increase as there is direct cost savings. Thus, there is some support to H6 and H7.

H8: Because of consumer information advantages, pioneers have higher shares in industries where products have a low purchase price and low purchase frequency and lower shares in industries where products are changed on a seasonal or annual or periodic basis.

From H3, we know that pioneer low price variable is not present. Pioneers with low purchase frequency is insignificant. Pioneers where products are changed on an annual or periodic basis is insignificant. **Pioneers where products are changed on a seasonal basis are estimated to have 30.89 share point loss.** Therefore, only PSC is statistically significant, and **it offers some support to H8.**

H9: Deterioration of pioneer product quality, product line breadth, price and absolute cost savings over time leads to lower pioneer shares.

Since we don't have 20-year-old pioneer and early follower variables in our dataset. We can't find the pioneer effect on market share over time. Thus, no support for H9.

**b. Run a simple regression model of market share as given in the first equation. What is the effect of pioneering on market share using this simple model? How does this effect change across different models?**

**The SAS System**

**The REG Procedure**
**Model: MODEL1**
**Dependent Variable: ms ms**

| | |
|---|---|
| Number of Observations Read | 1287 |
| Number of Observations Used | 1287 |

**Analysis of Variance**

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Model | 11 | 166359 | 15124 | 76.21 | <.0001 |
| Error | 1275 | 253003 | 198.43348 | | |
| Corrected Total | 1286 | 419362 | | | |

| | | | |
|---|---|---|---|
| Root MSE | 14.08664 | R-Square | 0.3967 |
| Dependent Mean | 24.86892 | Adj R-Sq | 0.3915 |
| Coeff Var | 56.64356 | | |

**Parameter Estimates**

| Variable | Label | DF | Parameter Estimate | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|---|---|
| Intercept | Intercept | 1 | 47.10577 | 7.93726 | 5.93 | <.0001 |
| qual | qual | 1 | 0.16803 | 0.01669 | 10.07 | <.0001 |
| plb | plb | 1 | -0.48873 | 0.06034 | -8.10 | <.0001 |
| price | price | 1 | 0.33801 | 0.07833 | 4.32 | <.0001 |
| pion | pion | 1 | 9.85044 | 1.23538 | 7.97 | <.0001 |
| ef | ef | 1 | 4.96093 | 1.21283 | 4.09 | <.0001 |
| phpf | phpf | 1 | 1.49996 | 1.20434 | 1.25 | 0.2132 |
| plpf | plpf | 1 | 1.15149 | 2.71867 | 0.42 | 0.6720 |
| psc | psc | 1 | -20.89740 | 9.99172 | -2.09 | 0.0367 |
| papc | papc | 1 | -1.11110 | 1.55504 | -0.71 | 0.4750 |
| ncomp | ncomp | 1 | -7.53340 | 0.37779 | -19.94 | <.0001 |
| mktexp | mktexp | 1 | -0.11006 | 0.07492 | -1.47 | 0.1421 |

Effect of market pioneering on market share is significant as its t-value > 1.96. If a company is a pioneer, then the market share increases **by 9.85 units.**

2SLS considers the effect of instrument variables and thus gives a better parameter estimate of pioneering on market share over OLS method **(7.17+ 1.804 = 8.97).** Moreover, 2SLS takes out the effect of error terms in all the variables. Since there is a simultaneity bias in OLS model **(9.85)**, OLS gives biased estimates whereas 2SLS removes the simultaneity bias caused by the endogenous variables.