FEASIBILITY OF A TERMS BANK FOR SMALL HORSEPOWER TRACTORS

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ABSTRACT

The Agriculture Equipment Manufacturing industry is a $42 billion dollar industry in the United States. The Agricultural Equipment industry is very competitive across all market segments, especially in the less than 100 horsepower category (<100hp). This tractor category consists of 4 sub categories: <20hp, 20-40hp, 40-60hp, and 60-100hp. The <100hp tractor segment accounted for 170,547 of the 207,833 tractors that were sold during the 2014 year. Compared to the over 100 horsepower category (100+hp) that has fewer competitors, the <100hp segment is more competitive with more manufacturers competing for market share.

Company XYZ is a full line manufacturer of agricultural equipment, harvesters, and construction equipment. Company XYZ lost some ground in market share due to the increased competition from new entrants into the market place as well as established manufacturers increasing their presence. To be more competitive, Company XYZ is looking at industry best practices to see how they can increase market share. One of these practices is a terms bank. A terms bank allows a dealer to stockpile unused months of terms to be used at a later date on tractors with expired terms. This minimizes financial risk for dealers to stock inventory. The cost to stock inventory is a large expense that dealers must carefully manage. One of the biggest costs of stocking inventory is the interest paid for tractors that have exhausted their interest free terms. A terms bank may lower the amount of interest that a dealer pays. It also lowers the cost to stock inventory and allows the dealership to manage and reduce these costs and risks. Evaluating the factors associated with stocking inventory, especially interest rate, will help manage

inventory costs and stocking levels. This thesis uses regression analyses to analyze the costs of stocking units and the effect it has on dealership revenues. A regression analysis will test the hypothesis that lowering the interest portion of the cost of stocking inventory will increase sales. Data were gathered for dealership groups in the Western United States on a monthly basis for the years 2008 – 2014. The results supported the hypothesis that lowering the interest rate at dealerships was positively correlated with revenues. The reduced interest cost lowers the carrying cost of inventory and point to a terms bank being an effective tool for increasing Company XYZ's market share.

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CHAPTER I: INTRODUCTION

1.1 Industry Overview

The Agricultural Equipment Manufacturing industry is a $42 billion dollar industry in the United States. In 2014, there were a total of 207,833 tractors sold in the United States (Association of Equipment Manufacturers 2015). Of the total tractors, 170,547 were less than 100 horsepower (<100hp) and 109,424 are less than 40 horsepower (<40hp). There are five manufacturers who comprise 90% of the sales of tractors: AGCO, CaseIH, John Deere, Kubota, and New Holland (MarketLine Industry Profiles 2014). The remaining 10% is comprised of smaller manufacturers: Mahindra, Branson, Kioti, YanMar and other smaller manufacturers. In the <40hp market, Kubota is the market share leader (Simpson 2013).

To better understand the industry in the United States as a whole, Porters five forces analysis is used. The five forces are Bargaining Power of Customers, Bargaining power of Suppliers, Threat of new entrants, Threat of substitutes, and Intensity of Competitive Rivalry (Porter Five Forces Analysis 2015).

Bargaining Power of Customers: The <100hp market is mostly made up of small farms and large acre residential consumers. These farms and consumers usually buy one or two tractors at a time. They buy individually and therefore have relatively little to no bargaining power.

Bargaining power of Suppliers: Suppliers provide raw materials and components to the manufacturers. Since quality of the tractors are important to the manufacturer, quality is needed from the suppliers too. This increases the supplier power.

Threat of New Entrants: Barriers to entry are very high in the agricultural equipment manufacturing industry. Manufacturers are highly concentrated who possess scales of economies. Because of this new entrants are not very common.

Threat of Substitutes: There are very few substitutes. Used equipment is the biggest threat of substitutes.

Intensity of Competitive Rivalry: The industry is very concentrated and this reduces rivalry.

To get an idea of how competitive the industry is, Table 1.1 below shows tractors from all 5 of the major brands in the <100hp tractors. Using the configuration feature on each manufacturer's website, tractors were configured to be identical. All tractors were between 33 to 38 horsepower, and were configured to have Roll Over Protection Structure (ROPS), 4WD, R4 tires, gear transmissions, and a loader. They each have the Tier 4 Final engines. Prices include both the tractor and a loader and are the Manufacturer's Suggested Retail Price (MSRP).

Table 1.1: Make and Model, Pricing, and Horsepower of Five Major Tractor Manufacturers

Make and Model	Price	horsepower
CaseIH Farmall 30C	$ 30,244.00	33hp
John Deere 3033	$ 29,454.00	33hp
Kubota 3301	$ 24,975.00	33hp
Massey Fergusson 2605	$ 28,135.00	38hp
New Holland Boomer 33	$ 29,235.00	33hp

1.2 Company XYZ

Company XYZ's market share of the <100hp tractors has been declining over the past 10 years, especially in the <40hp market. The objective of this thesis is to analyze how Company XYZ can increase market share of <100hp tractors in North America.

One of the biggest items needed to increase market share is inventory. Dealers need to have adequate numbers of tractors at the dealership level to increase market share. If there is not enough inventory of tractors at Company XYZ dealerships throughout the year, in comparison to the rest of the industry, then an increase in market share may not happen. Stocking levels of <100hp tractors at most Company XYZ dealerships, in comparison to our competitors, are low. There are many reasons why this is the case. The biggest reason, which is Company XYZ's greatest challenge, is because the interest free stocking terms of equipment is so short. This translates into a lot of financial risk for the dealerships and therefore the dealers do not stock the necessary units needed to increase market share.

A competitor of Company XYZ that uses a terms bank is Kubota. A terms bank consists of unused months of interest free stocking terms that are put into a "bank" that can be applied to a tractor that does not sell during the original interest free stocking period. Company XYZ is at a market disadvantage compared to their competitor since they do not use a terms bank. This thesis will analyze how a terms bank will help to achieve the overall goal of increasing Company XYZ's market share of <100hp tractors in North America.

1.3 Background

Company XYZ dealers who sell <100hp tractors currently will receive between 4-8 months of interest free terms. When a tractor is invoiced to the dealership, the finance division of XYZ, called XYZ Capital, floors the unit. Company XYZ pays the interest to XYZ Capital until either the tractor is sold, or the interest free term has ended after 4-8

months. When the terms end, the unit becomes due. The dealer has to pay XYZ Capital the amount owed on the unit. The dealer does have the option to pay the interest for 4 more months. At the end of those 4 months, the unit is final due or there is an option to make payments to pay down the principle. When a unit comes due, the tractor's carrying costs increases and becomes a financial liability. The idea is to sell the tractor before the terms run out so that the dealership does not pay interest, make payments, or eventually pay off the unit. The more interest the dealers pay, the higher the financial risk. If the unit becomes final due, this is a large risk and ties up capital. The other outcome is that the dealer panics and sells the tractor for no profit or at a loss, which is financially unsustainable. This is especially important when placing tractor orders for the following year.

Most Company XYZ dealers are very conservative when placing orders so they do not overstock and have to pay interest, make payments, and/or pay off the unit. Ideally, the unit will retail before terms run out and no interest will be paid. Careful inventory management still can have downfalls. Terms of 4-8 months are often not long enough to get them through the selling season. The selling season is usually March through October, with March through July being the highest selling months. If the tractors are delivered late or early, the terms may not be sufficient to get them through the selling season. To reduce this risk, dealers will order very minimally and usually only what they know they will sell. This negatively affects customer perception. Understocked dealership lots give the perception that the dealer is not in business to sell <100hp tractors. Also, parts and service revenues may be smaller also. The more tractors sold equals higher parts and service

revenues. Parts and service account for the highest margins and biggest profits at a dealership.

In contrast, Kubota offers 9 to 12 months of interest free terms. Compared to Company XYZ dealers, the financial risks associated with stocking Kubota tractors are less. Dealers that sell Kubota tractors have enough interest free terms to last through the selling season. If a tractor does not sell this year, there could be enough terms to get them through until the following year, depending on when the unit was invoiced originally. Kubota takes it one step further by offering a terms bank. A terms bank is a pool of leftover unused months of terms that can be applied to other tractors that have used all of their original stocking terms. For example, if a dealer orders 10 tractors and they all receive 12 months terms, there are 120 months of total terms for those 10 tractors. If 6 of the tractors sell in the first month, they still have 11 months of terms left. So those 6 tractors with 11 months terms (66 months in total) are put into a "bank". If one of the tractors takes 15 months to sell, the dealer has to pay 3 months interest to Kubota. Since they have 66 months in the bank, they take 3 of those months and put it towards that tractor. They end up paying no interest and still have 63 months left. This is similar to how cell phone companies offer "roll over" minutes. If a customer did not use all of their minutes in one month, the left over minutes are rolled into the next month.

Kubota dealers have very low risk associated with stocking tractors. Kubota dealers almost never pay interest on the tractors. Because the risk is so low, Kubota dealers tend to stock many units. This gives a favorable impression to customers seeing dealerships with inventory and that they are highly successful. It also means more business for the parts and service departments. Most importantly, it means very high market share.

Kubota does other things to increase and maintain market share. They make a quality product. They usually ship 100% of the following year's tractor orders to dealers by the beginning of their selling season so the dealership lots are full. They also have very reasonable freight charges to get the tractor from the factory to the dealer. Kubota is vertically integrated. Their brand equity is high. They have a big dealer network, especially in the western half of the United States. They also have a pool of inventory in strategic locations around the country that can backfill tractors as they sell.

In comparison, Company XYZ makes a high quality product that competes with Kubota and other competitors. However, Company XYZ has many challenges. Tractors are not always delivered when the dealers request them and arrive months early or months late due to production and freight challenges. Company XYZ dealership inventory stocking is often insufficient for the local demand. Freight can be free if ordered in full containers. If not, freight is very expensive. Company XYZ is not totally vertically integrated and has a marketing agreement with LS Tractors in Korea, who manufactures the <40hp tractors. Company XYZ's dealer network is not as extensive in compact markets as Kubota's. Company XYZ does have a pool of tractors but is very expensive to ship them to the dealership. These are huge strategic differences between Kubota and Company XYZ. These are many of the main reasons why Kubota is the market leader in compact tractors. It was not long ago that Company XYZ had greater than 25% market share. In 2014, Company XYZ is less than 5% in the <40hp and 5-10% market share in the 40-100hp segment. To regain market share, more tractors need to be sold, which means that more tractors need to be ordered and placed on dealers' lots. Reducing the risk from terms may have an immediate positive impact on the market share.

1.4 Objectives

The objectives of the thesis are as follows:

1. Determine the effects, if any, that interest rate has on revenues of <100hp tractors
2. Determine the effects, if any, that market share and monthly sales of <100hp tractors have on a dealerships monthly revenues.
3. Evaluate and provide a conclusion for the estimated results

1.5 Thesis Outline

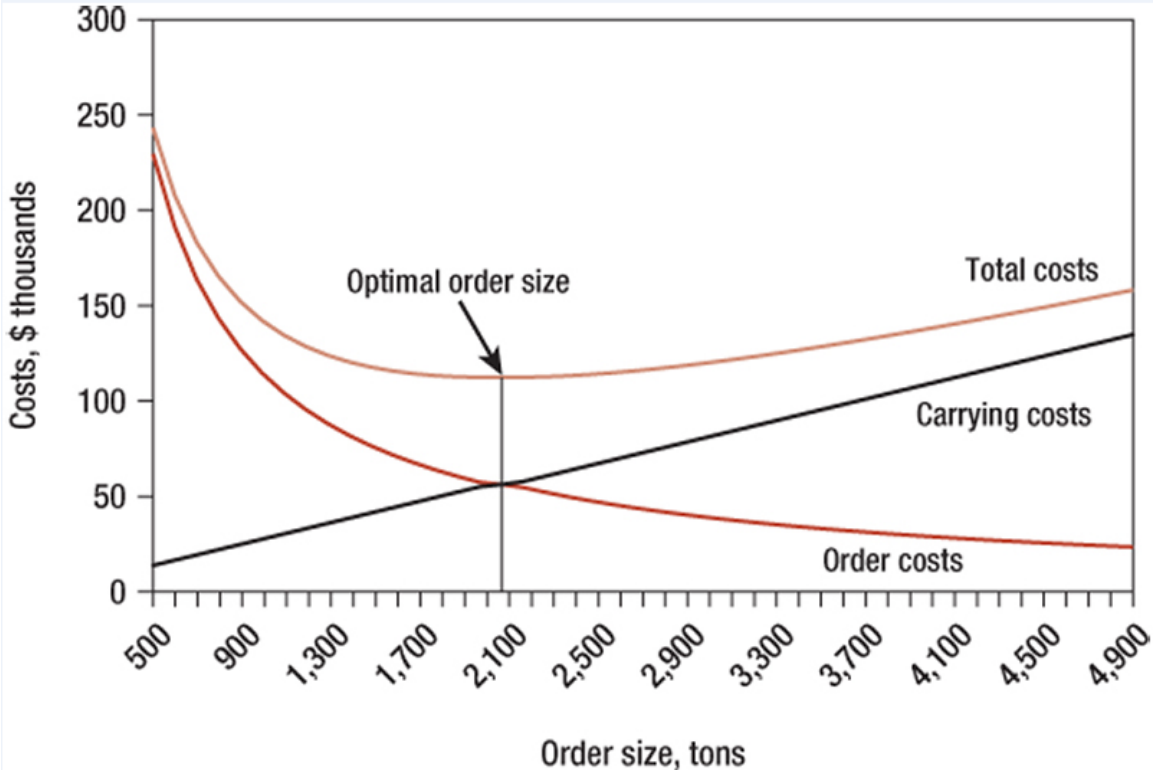
The thesis will consist of four chapters. The next chapter will be a brief literature review of what has already been research and published about interest expense portion of the carrying cost of inventory. The third chapter, the theory section, will examine the carrying cost of inventory theory. The fourth section will be the methods section. Econometric analysis is discussed to create models for evaluating the objectives. The last chapter is the summary and conclusion.

CHAPTER II: THEORY

2.1 Carrying Cost of Inventory

Carrying Cost of Inventory is defined as "The cost a business incurs over a certain period of time, to hold and store its inventory. Businesses use this figure to help them determine how much profit can be made on current inventory. It also helps them find out if there is a need to produce more or less, in order to keep up with expenses or maintain the same income stream" (Investopedia n.d.). It can also be referred to as carry cost of inventory or as inventory cost.

Figure 2:1 Carrying Costs effects on Optimal Order Size to Determine Order Size



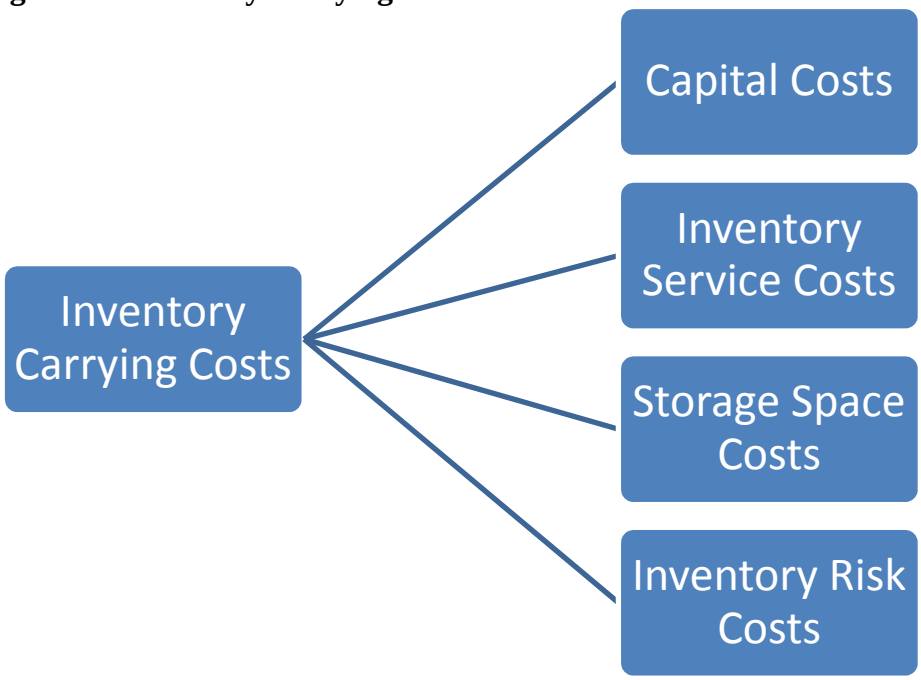
(Brealey, Myers and Allen 2011)

The graph from *Principles of Corporate Finance* (Brealey, Myers and Allen 2011) shows the effect of carrying costs on the order size. As carrying costs go up, so do the total costs.

The carrying cost curve shifts upward and the order size decreases. In the case of Company XYZ dealerships looking to order more tractors to increase market share, the more interest paid will result in higher carrying costs. That will result in a lower ordering size. Market share increases will not happen with smaller ordering sizes.

What makes up Inventory Carry Costs? REM Associates says there are four areas of Inventory Carrying Costs: Capital Costs, Inventory Service Costs, Storage Space Costs, and Inventory Risk Costs (REM Associates of Princeton, Inc n.d.).

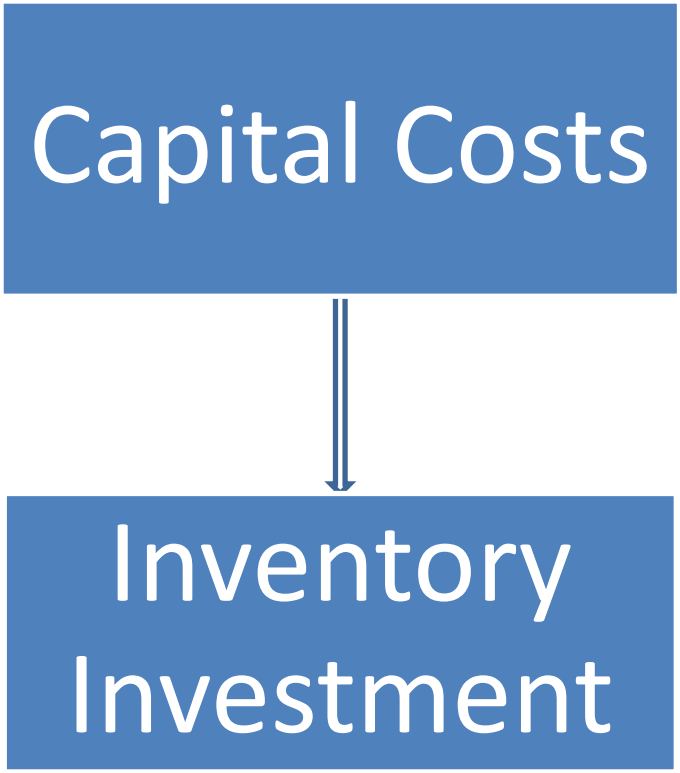
Figure 2:2 Inventory Carrying Costs



(REM Associates of Princeton, Inc n.d.)

The Capital Costs include the investment in inventory. One of the costs of the investment in inventory is interest paid. Interest increases the risk and effects the decisions on how much to invest in inventory.

Figure 2:3 Capital Costs include the investment in inventory



(REM Associates of Princeton, Inc n.d.)

How much can the inventory carrying costs be? From the estimates provided by REM Associates, this can be as much as 25% (REM Associates of Princeton, Inc n.d.). The obsolescence for most tractors is almost 0%. Out of the 25% that REM Associates suggest, 6-12% is the cost of capital. That is the biggest part of inventory carrying costs and why the risk factor of the inventory investment is high for Company XYZ dealerships.

Figure 2:4 Total Inventory Carrying Costs

Total Inventory Carry Costs Can Be Estimated At….	
- Cost of Money	6% - 12%
- Taxes	2% - 6%
- Insurance	1% - 3%
- Warehouse Expenses	2% - 5%
- Physical Handling	2% - 5%
- Clerical and Inventory Control	3% - 6%
- Obsolescence	6% - 12%
- Deteriation & Pilferage	3% - 6%
Total	25% - 55%

(REM Associates of Princeton, Inc n.d.)

One of the biggest risk factors for a Company XYZ dealership when looking at the carrying cost of inventory is interest and units coming due. Company XYZ gives dealers anywhere from 4-8 months of interest free flooring terms on <100hp tractors. At the end of the term, the unit comes due. All dealers have an account with XYZ capital who finances the new equipment. At this point, there are several options. They have two lines of credit for new tractors. One is for tractors with terms on them. The dealer does not pay any interest during this time and makes no payments on the tractors. The other is for mature new tractors. Once terms run out, the dealership will move it over to the mature new line. There are no terms left and dealerships start paying interest on the balance of the tractor, usually in the 7-9% range. They also start paying down the principle of the tractor or pay off the tractor entirely. Most dealers have a line of credit with their local bank who can

provide a 2-4% interest note and save the dealership interest expense. The 4-8 months of interest free flooring terms allows the dealers to not tie up credit and cash in inventory. Most of the time, the 4-8 months terms coincide with the "selling season", or when the dealership will sell most of their inventory during the year. This varies from dealership to dealership and from different types and categories of tractors. A dealership also manages their orders to arrive at the dealership at different times of the year so that not all of the inventory needed for the year is sitting on their lot all at once. The idea is to maximize the months of terms so that a tractor is sold before they run out. By spacing them out through the year, all tractors ideally will be sold before terms run out and the units come due.

When a dealer has a tractor that is retailed while the terms are still on the unit, the interest part of carrying costs of inventory is zero. When the terms run out and a dealer has to start paying interest, making payments, and/or paying off the tractor, the interest part of the carrying costs go up. It becomes expensive and risky to stock units. Because of this, Company XYZ dealers are very risk adverse and stock conservatively and cautiously. If Company XYZ were to implement a terms bank, it would lower the dealer's carrying cost of inventory. It will also lower the dealer's risk of stocking inventory and be in a better position to gain market share. Company XYZ has seen success with Hay and Forage Equipment by reducing the dealer's interest portion of the carrying cost of inventory. These products are the highest market share category for Company XYZ.

Terms for Hay and Forage Equipment are anywhere from 6-23 months. The average terms are about 12-22 months. This equates to less risk of paying interest and dealers are more willing to stock equipment. Dealers will pay little to no interest on this equipment as they sell it before terms run out and greatly reduces the amount, if any, of the

interest portion of the carrying cost of inventory. Since there is more equipment on the lot, market share for Hay and Forage Equipment may be higher. In fact, to help entice dealers to order the correct amount of equipment to grow market share or at least maintain market share, Company XYZ has carryover terms. To meet carryover terms, the dealer has to sell at least 50% of the total quantity of the Hay and Forage equipment they ordered for the year. Ordering happens once a year and is optimal for inventory management. Once they have sold 50% or more of the equipment, they qualify for carryover. Carryover results in an extra 8 months of terms to get them through the winter and into the next hay and forage season. Dealers see this as lowering risk, especially compared to <100hp tractors. Dealerships can sell at least 50% of what they ordered 19 out of 20 years so the risk is very minimal. Their interest portion of the carrying cost of inventory is low. Having a terms bank for <100hp tractors would create the same effect on stocking levels of tractors. Dealers would view the interest portion of their carrying cost of inventory risk very low and therefore be very aggressive on going after market share.

CHAPTER III: METHOD

To address the question of using a terms bank to reduce the carrying cost of inventory of <100hp tractors and therefore increase market share, this thesis will use regression analysis.

3.1 Dependent Variable

Revenue per month of <100hp tractor sales by dealership- This is the total amount (revenue) of the selling price for all <100hp tractors sold each month by dealer. Revenue is affected by interest rate, market share, and the total amount of tractors sold each month. The correlation of revenue with the independent variables will help to evaluate lowering the interest cost and thus lowering the carrying cost of inventory.

3.2 Independent Variables

Sales of <100hp tractors per month by dealership- This will be total number of units (Sales) sold each month for all tractors less than 100hp.

Starting inventory per month by dealership- This is a count of the total amount of less than 100hp tractors at the dealership (StartInv) at the beginning of each month. Market share can't be gained selling from an empty lot. Is there a correlation between the stocking level and the dollar sales each month of those tractors?

Interest rate by month for each dealership - This is the percentage interest rate for equipment (IntRate) when they have run out of terms and becomes interest bearing. Interest paid to XYZ Industrial Capital can become very expensive. It increases the carrying cost of inventory and dealers become more risk adverse.

Market Share by month of <100hp tractors - Market share by month (MktShr) is calculated by taking the amount of <100hp tractors sold in the industry from that dealer's Primary Market of Responsibility (PMR) and dividing it by the number of tractors sold by

the dealership in the same PMR. The PMR are counties assigned to the dealership by Company XYZ. Dealers will have tractor sales that will not be reported into the market share number because they sold outside their PMR.

The estimated regression equation is:

$$Revenue = \beta_0 + \beta_1 Sales + \beta_2 StartInv + \beta_3 IntRate + \beta_4 MktShr + \varepsilon$$

Table 3.1: Variables and Definitions of the Variables

Variable	Definition
Revenue	Summary of all <100hp tractor selling price per month
Sales	Summary of unit count of sales of <100hp tractors per month
StartInv	Summary of all <100hp tractor in dealer inventory at the beginning of each month
IntRate	Interest rate by month that a dealership is paying for matured new inventory (terms have ended and unit is interest bearing
MktShr	Summary of <100hp tractor sold divided by summary of tractors sold in the Industry in the dealerships Primary Market of Responsibility (PMR)

3.3 Data

The data will be from 37 dealerships. All of the dealers lie in the Western part of the United States and comes from internal Company XYZ sources. The data are from a 7 year period beginning in 2008 and ending in 2014 and reported for each month (seven years times 12 months for a total of 84 months). There are 4 categories of tractor sales reported. There are <20hp, 20-39hp, 40-59hp, and 60-99hp which make up the <100hp tractor category. When the regressions are estimated, they are for the <100hp tractor category. The 37 dealerships represent a portion of the total United States <100hp tractor

sales. The dealers cater to a city/metro market where the sales are primarily compact and subcompact tractors in the <40hp categories. The rest are represented by production agriculture. Most of these tractors are in the specialty agriculture market: grapes, orchards, nuts, berries, etc.

To evaluate if a terms bank will have a positive effect on market share and reduce the carrying cost of inventory, a regression is estimated. From the results of the regression, sensitivity analysis is completed to see the effects that different interest rates have on monthly revenues. Expected results are that lower interest rates will increase the revenue per month of <100hp tractors per month. This will lead to increased sales of tractors and an increase in market share. This may suggest that a lower interest rate will reduce the carrying cost of inventory and reduce the risk of stocking tractors. It will lower the effective interest rate and reduce the carrying cost of inventory.

3.4 Expected Coefficient Signs:

The expected coefficients signs for the equation are as follows:

- For *Sales*, a positive coefficient is expected. An increase in the number of tractors sold each month will result in increased revenue
- For *StartInv*, a positive coefficient is expected. An increase in the amount of beginning inventory will mean more sales on average. Eventually, a dealership can have so much inventory that they don't stock more than the industry yearly average.
- For *IntRate*, a negative coefficient is expected. An increase in the interest rate will result in smaller revenues per month.
- For *MktShr*, a positive coefficient is expected. An increase in market share will result in larger revenues per month for the dealership.

Table 3.2: Expected Coefficient signs and Null Hypothesis of Sales, StartInv, IntRate, and MktShr

Coefficient	*β1Sales*	β2StartInv	*β3IntRate*	*β4MktShr*
Hypothesized sign	+	+	-	+
H_O	β1Sales ≤0	β2StartInv ≤0	β3IntRate ≥0	β4MktShr ≤0
H_A	β1*Sales* >0	β2*StartInv* >0	β3*IntRate* <0	β4*MktShr* >0
t-statistic	1.645	1.645	1.645	1.645

The degrees of freedom will be one sided at the 5% significance level. When gathering the data, it became apparent that the data for starting inventory would be too difficult as the data wasn't always available. That variable was dropped and is discussed later in the methods section. The estimate regression equation is:

$$Revenue = \beta_0 + \beta_1 Sales + \beta_2 IntRate + \beta_3 MktShr + \varepsilon$$

All econometric and statistical analyses were conducted using Stata13.

Table 3.3: Summary of Regression Equation

Variable	Obs	Mean	Std. Dev.	Min	Max
Revenue	3108	120040.1	290171	0	3946729
Sales	3108	4.082368	10.00938	0	154
IntRate	3108	8.0125	0.717055	7.75	11.48
MktShr	3108	21.02948	71.07448	0	1400

Figure 3.1: Dealership Monthly Revenue Averages 2008 - 2014

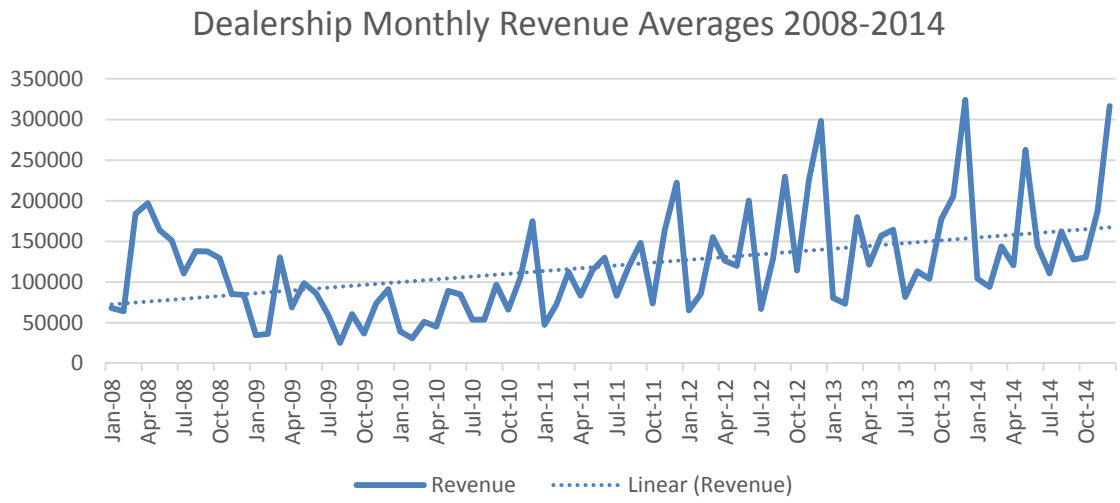
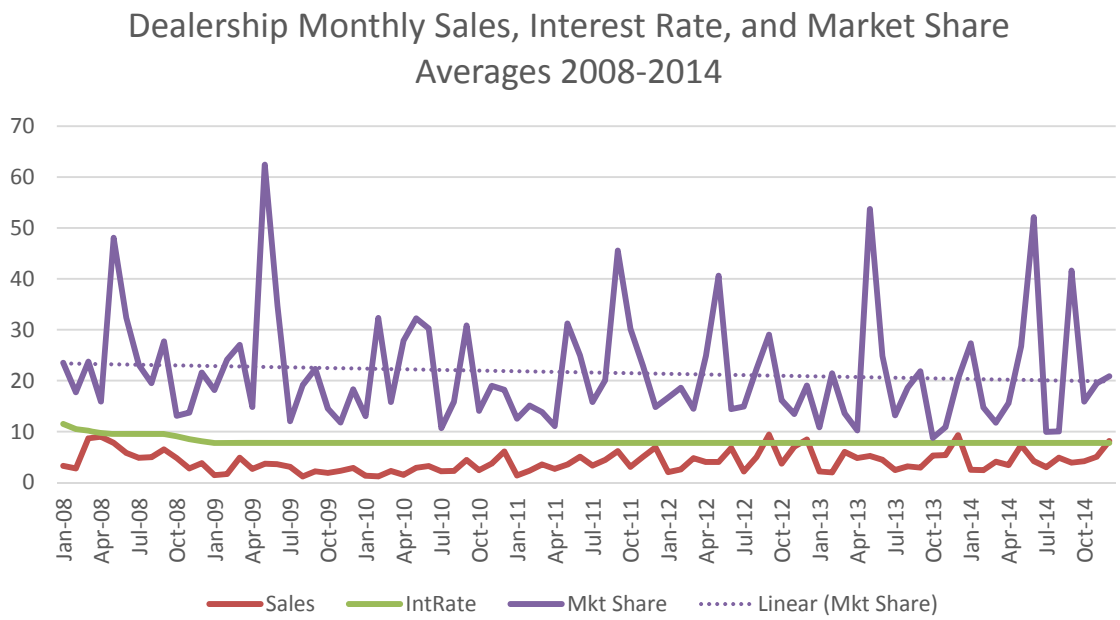


Figure 3.2: Dealership Monthly Sales, Interest Rate, and Market Share Averages 2008 - 2014



The estimated results are in Table 3.4.

Table 3.4: Regression results of Revenue = f(Sales, IntRate, MktShr)

	Coefficient	Standard Error	t	P>|t|
Sales	27053.85	188.9854	143.15	0.000
IntRate	-16971.04	2616.835	-6.49	0.000
MktShr	72.32723	26.5679	2.72	0.007
_cons	144160.5	21032.28	6.85	0.000
R-Squared	87.48			

The interpretation of the estimated coefficients are as follows:

- For every unit sold, the revenue (*Revenue*) for the dealership increase by $27,053.90.
- For every point increase of the interest rate (*IntRate*) that XYZ Industrial Capital charges the dealership for tractors that have run out of terms and are mature, revenues decrease by $16,971.
- For every point increase of market share (*MktShr*), revenues increase by $72..

For the t-test, all three coefficients are statistically significant and of the expected sign.

3.5 Addition of Quarterly Dummy Variables

To further evaluate the estimated regression equation, quarterly dummy variables to account for seasonality were added. Adding quarterly dummy variables evaluated what time of the year products need to be in place for the "selling season". Tractors <100hp are very seasonal, especially in the <40hp market. This will help to evaluate if selling during certain times of the year increases revenues, grow market share, and decrease carrying cost of inventory. It will also allow for inventory planning. If the best time of the year to sell is Q1, then tractors need to arrive in Q4 of the previous year. This will allow time for setup and moving units to the lot. The new regression equation is now as follows:

$$Revenue = \beta_0 + \beta_1 Sales + \beta_2 IntRate + \beta_3 MktShr + \beta_4 Q1 + \beta_5 Q2 + \beta_6 Q3 + \varepsilon$$

The expected coefficient signs are illustrated in table 3.5.

Table 3.5: Expected Coefficient signs and Null Hypothesis of Sales, StartInv, IntRate, MktShr, Q1, Q2, and Q3

Coefficient	β1Sales	β2IntRate	β3MktShr	β4Q1	β5Q2	β6Q3
Hypothesized sign	+	-	+	-	+	-
HO	$\beta 1 Sales \leq 0$	$\beta 2 IntRate \geq 0$	$\beta 3 MktShr \leq 0$	$\beta 4 Q1 \geq 0$	$\beta 5 Q2 \leq 0$	$\beta 6 Q3 \geq 0$
HA	$\beta 1 Sales > 0$	$\beta 2 IntRate < 0$	$\beta 3 MktShr > 0$	$\beta 4 Q1 < 0$	$\beta 5 Q2 > 0$	$\beta 6 Q3 < 0$
t-statistic	1.645	1.645	1.645	1.645	1.645	1.645

The expected sign for *Q1* and *Q3* is negative. Sales of <100hp equipment is not as strong in these quarters as in Q2 and Q4. Q1 is when winter is in full swing and motivation to purchase is low. Q2 is when spring arrives and the need for tractors increases and this equipment sells the best. Q3 is the summer and customers who bought in Q2 are using their equipment. Q4 brings about the buyers who buy for end of year tax purposes. For these reasons, I expect Q2 to be positive. I will test at the 5% significant level of a one sided test.

The estimate regression output is illustrated in Table 3.6.

Table 3.6: Regression results of Revenue as a function of (Sales, IntRate, MktShr, Q1, Q2, and Q3)

	Coefficient	Standard Error	t	P>|t|
Sales	27033.49	188.98	143.04	0.000
IntRate	-16132.88	2642.919	-6.1	0.000
MktShr	65.45001	26.55462	2.46	0.014
Q1	-12635.87	5381.331	-2.35	0.019
Q2	-15136.57	5300.483	-2.86	0.004
Q3	-23258.64	5304.935	-4.38	0.000
_cons	150425.2	21095.5	7.13	0.000
R-Squared	87.56%			

The coefficient signs for *Sales*, *MktShr*, and *IntRate* are as expected and similar to the first model. However, one of the signs of the quarterly dummy variable is not as expected. *Q2* was predicted to be positive but is actually negative. This is saying is that the expected difference between the values of *Revenue* in the first quarter versus that in the fourth quarter is -$12,636. The coefficient for *Q2* is -$15,137 and *Q3* is -$23,259 less than *Q4*. In looking at the null hypothesis of the regression, all but one is statistically rejected.

Q2 did not have the expected sign. Upon further review the estimated regression results indicate that revenue is highest in *Q4*. Company XYZ offers extra discounts during this time to clear old model inventory so that the new models can arrive at the dealerships for the following year's sales.

3.6 Statistical Significance

The R^2 is high indicating the overall fit of the regression is good. The t-test for all of the coefficients mean they are all statistically significant. To make sure that all of the coefficients are statistically significant as a group, a F-test was estimated. The unrestricted model was:

$$Revenue = \beta_0 + \beta_1 Sales + \beta_2 IntRate + \beta_3 MktShr + \beta_4 Q1 + \beta_5 Q2 + \beta_6 Q3 + \varepsilon$$

The restricted model will be:

$$Revenue = \beta_0 + \beta_1 Sales + \beta_2 IntRate + \beta_3 MktShr + \varepsilon$$

The hypothesis will be

H_0: $\beta_4 = \beta_5 = \beta_6 = 0$

H_A: Not H_0

F=6.593

Critical F-Value at 5% significant level, $F_{0.05, 3, 3049} = 2.60$

The Null hypothesis is rejected and the conclusion is that there is a joint statistical significance of the group of the quarterly variables.

3.7 Addition of Beginning Inventory of One Selected Dealership

As stated earlier, the original regression model included the beginning inventory for each dealership each month. Due to the way the data were obtained, it was an insurmountable task to pull out the data for all 37 dealerships for <100hp tractors over 8 years. The variable was dropped. To examine if this variable should be included, data for one dealership were collected so a regression could be ran with this added variable. The dummy variables were kept in the model. The new model is:

$$Revenue = \beta_0 + \beta_1 Sales + \beta_2 IntRate + \beta_3 MktShr + \beta_4 Q1 + \beta_5 Q2 + \beta_6 Q3 + \beta_7 StartInv + \varepsilon$$

The expected Coefficient signs and t-stats are found in Table 3.7.

Table 3.7: Expected Coefficient Signs and Null Hypothesis of Sales, IntRate, MktShr, Q1, Q2, Q3, and StartInv for One Selected Dealership

Coefficient	β_1*Sales*	β_2*IntRate*	β_3*MktShr*	β_4*Q1*	β_5*Q2*	β_6*Q3*	β_7*StartInv*
Hypothesized sign	+	-	+	-	-	-	+
H_O	β_1*Sales* ≤ 0	β_2*IntRate* ≥ 0	β_3*MktShr* ≤ 0	β_4*Q1* ≥ 0	β_5*Q2* ≥ 0	β_6*Q3* ≥ 0	β_7*StartInv* ≤ 0
H_A	β_1*Sales* >0	β_2*IntRate* <0	β_3*MktShr* >0	β_4*Q1* <0	β_5*Q2* <0	β_6*Q3* <0	β_7*StartInv* >0
t-statistic	1.645	1.645	1.645	1.645	1.645		1.645

All repeated coefficients will have the same expected signs, with the exception of *Q2*. I have changed the expected sign to be negative based upon the results of the regression above. *StartInv* is expected to have a positive sign and will be tested at the 5% one sided significance level.

Table 3.8: Summary of Data for One Selected Dealer

Variable	Obs	Mean	Std. Dev.	Min	Max
Revenue	84	298620.9	303863.6	0	1842510
Sales	84	15.42857	19.01508	0	115
IntRate	84	8.0125	0.721245	7.75	11.48
Q1	84	0.25	0.435613	0	1
Q2	84	0.25	0.435613	0	1
Q3	84	0.25	0.435613	0	1
MktShr	84	11.76012	9.56503	0	43.4
BegInv	84	141.869	85.18043	50	435

Table 3.9: Regression Results of Revenue as a Function of Sales, IntRate, MktShr, Q1, Q2, Q3 and Inventory for One Selected Dealership

	Coefficient	Standard Error	t	P>|t|
Sales	14699.13	1037.916	14.16	0.000
IntRate	1779.385	1914.333	0.93	0.356
MktShr	-14779.53	17395.61	-0.85	0.398
Q1	-50985.43	28213.84	-1.81	0.075
Q2	9123.714	30342.99	0.3	0.764
Q3	-30823.79	27554.65	-1.12	0.267
BegInv	-4.264104	126.1177	-0.03	0.973
_cons	188105.9	130657.7	1.44	0.154
R-Squared	92.77%			

The negative coefficient sign for *StartInv* was not as expected. The only statistically significant variables are *Sales* and *Q1*. The interesting thing is that the overall fit is very high at 0.9277. The signs for all of the coefficients are as expected with the exception of *Q2* and *StartInv.* The fact that each additional unit of beginning inventory only decreases revenues by $4.26 means it really has little effect and should not be included in this regression. This model has signs of multicollinearity. There is a high R^2 and few significant coefficients that had low t-stats. Since most of the coefficients are not statistically significant, there are two conclusions to draw from this regression analysis in addition to multicollinearity. One is that adding the starting inventory each month does not statistically have an effect on revenues. The second is that the regression needs to be run with all 37 of the dealerships. One is not enough to come to a conclusion if the starting

monthly inventory has an effect on monthly revenues. Having one dealership adds to multicollinearity. Adding all 37 dealerships and estimating the same model, as stated above will help to see if the coefficient is significant or not. Another observation to note is that the coefficient for *MktShr* is much larger in this regression for the one selected dealer compared to all 37 dealers. At 1,779.39 compared to 65.45 it is much higher.

3.8 Sensitivity Analysis:

To see what effect different interest rates have on the revenues of the dealership, sensitivity analysis is ran. For this sensitivity analysis, the variable *IntRate* will be changed in different increments to see what happens to *Revenue*. The analysis will use the estimated regression that has all 37 dealerships with the quarterly dummy variables.

The means from Table 3.3 are used. The *IntRate* variable is the only variable that is changed to see the effect on *Revenue*. The interest rate will start at 8%, which was the mean of all 37 dealers. I will evaluate in 1% increments starting at 10% and going down to 0%. The coefficient for *IntRate* was -16,971. For *Sales*, the coefficient of 27,054 and the mean from all 37 dealers of 5 units per month sold. For *MktShr*, the coefficient was 72.3 and the mean from all 37 dealers of 14.9% per month was used. The constant used for analysis was 144,160.5.

Table 3.10: Sensitivity Analysis of Interest rate and Revenue

Sensitivity Analysis

IntRate	*Revenue*	
10%	$ 110,797.27	
9%	$ 127,768.27	
8%	$ 144,739.27	Mean Interest Rate
7%	$ 161,710.27	
6%	$ 178,681.27	
5%	$ 195,652.27	
4%	$ 212,623.27	
3%	$ 229,594.27	
2%	$ 246,565.27	
1%	$ 263,536.27	
0%	$ 280,507.27	

The sensitivity shows that interest rate has a large impact on the revenues of the dealerships. Going from the revenues at 8% interest to 10% interest rate, the revenues decrease by $33,942, a 23.45% decrease in revenues. Going from the mean interest rate of 8% to 6% is an increase in revenues of $33,942, a 19% increase in revenues. Each 2% increment in the interest rate is a change of $33,942. If the dealer were to only pay 1% interest, the difference would be $118,797, a 45.08% increase in revenues. That is a large difference and potentially shows that lowering interest rate has a big impact on revenues.

CHAPTER IV: CONCLUSION

In the ever competitive market of Agricultural Equipment, Company XYZ is trying to increase market share in the $42 billion dollar industry in the United States. The <100hp market is the largest segment of the total number of tractors sold, and especially <40hp tractors. To regain market share and become a top competitor in the <100hp market, dealers need to stock adequate numbers of tractors in their inventory. Dealers are very risk adverse. They want to minimize their risks, especially of stocking inventory. The carrying cost of inventory can be quite high. This is especially true if Company XYZ is wanting to grow their market share. It means that dealerships have to stock more than they would normally.

One of the biggest factors of the carrying cost of inventory is the interest costs. Dealers want to decrease this cost as much as they can. Dealers also need adequate terms for their inventory to allow for enough time to sell the units. Currently, the terms are fairly short and dealers see this as high risk. In looking at the industry best practices, a major competitor to Company XYZ has adopted a terms bank. The terms bank lowers dealers inventory stocking risks, allows adequate time to retail the tractor, reduces the amount of interest the dealers have to pay, as well as allows dealers to stock the inventory needed to maintain market share. Company XYZ should look at this industry best practice in order to improve their market share.

In this thesis, a regression was estimated to see how interest rates affect revenues. The estimated regressions showed that all of the variables were statistically significant and had the predicted signs. Using the estimated regression equation, sensitivity analysis showed that the lower the interest rate, the higher the revenues and the higher the interest rate, the lower the revenues. This suggests that interest rates and revenues are negatively

correlated. These results and findings point to potentially what a terms bank accomplishes, it lowers the interest portion of carrying cost of inventory.

An improvement to the regression analysis would be to include all 37 dealers for beginning inventory. The difficulty to access this information made this not possible. Another idea is to add a variable that looks at the actual interest costs that each dealer paid from 2008 through 2014. Some dealers pay less interest than others as their inventory turns are higher and they sell the tractors before they come due. Adding this variable would help to evaluate the actual interest cost rather than just the average interest rate.

From the findings of the thesis paper, it is recommended that Company XYZ consider implementing a terms bank. It would increase stocking rates of tractors on dealers' lots, decrease carrying costs of inventory, lower risk of stocking adequate inventory, and ultimately help to increase market share. It is not the silver bullet to increasing market share, but it will mimic an industry best practice. For the terms bank to work, the next recommended step would be develop a plan to handle the increased inventory stocking level at dealerships. The key is to come up with a strategy that is a win-win for both the dealerships as well as Company XYZ. The dealers win because they stock more units, Company XYZ wins because market share increases. To prevent inventory from becoming stale or overstocked, increased inventory turns need to happen. This can be done through sales incentives or promotions that encourage dealers to sell long before their terms run out or for the need to use the terms that have built up in the terms bank. The increased turns means higher revenues for the dealerships and Company XYZ plant production remains high.

The next step would be to implement the terms bank at a select sampling of Company XYZ dealers to evaluate the impact of stocking levels of tractors, carrying cost of inventory, and ultimately market share. This would allow Company XYZ to analyze and determine if a terms bank would work on a small scale. If it worked, then the next step would be to implement it at all dealers nationwide.

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APPENDIX A

F-Test Calculations

Calculating the F test

$$F = \frac{(RSS_M - RSS)/M}{RSS/(N-K-1)}$$

$$F = \frac{((32{,}664{,}000{,}000{,}000 - 32{,}453{,}000{,}000{,}000)/3)}{((32{,}453{,}000{,}000{,}000/(3049-6-1))}$$

F=6.593