

Investment Risk Profiling Utilizing Business Resource Slack


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ABSTRACT

Financial investor classes are commonly depicted via a tripartite model that distinguishes among risk averse, risk neutral and risk seeking behaviors. This paper contributes to the literature by capturing the essence of risk tolerance in the context of a profit-maximizing firm's investment decision vis-à-vis the business' resource slack. The paradigm introduced in this paper contextualizes risk profiling in a rigorous manner which should augment treatments relayed in standard principles of finance textbooks. This paper illustrates that it is the existence or absence of resource slack that influences, if not dictates, a business' risk disposition.

INTRODUCTION: THE RISK / RETURN TRADE OFF

 Suppose you are driving your car and you need to visit, say, seven towns. It does not matter in what order or at what time to arrive at or depart from the towns, but your objective is to minimize total driving distance. You look at a map and in your mind connect the towns together with line segments and mentally decide in which order to drive to them. There are multiple paths the driver may take between any two cities. Also, different roads have different characteristics; some are congested, some are scenic, some are very safe, some are relatively treacherous, etc. However, for simplicity and in order to explicate the concept of risk aversion, let's limit the potential road characteristic differences to two variables: length and safety. Additionally, assume that the safer road segments are relatively longer in terms of miles.

How do you decide which path to take at each juncture? The simple answer is that if you are safety-minded, you take the safe path even if it is longer, and if you are dare-devilish you take the unsafe path, hoping to successfully navigate the risky elements in order to minimize total distance. (If given the opportunity, some drivers may take an unsafe path even when it is longer. This group, however, cannot be considered in our problem, as this behavior is not something that could be explicated mathematically. Such drivers are probably interesting subjects for study by psychologists.) The problem raised herein is one similarly faced by investors in the financial markets, namely, the risk-return trade off. Decisions rendered under the risk-return paradigm are a function of the decision-maker's risk attitude, typically articulated via a tripartite model based on risk averse, risk neutral and risk seeker tendencies.

RESOURCE SLACK IN EXPLICATING RISK PROFILING

Resource slack is defined as having cash (or near-cash) and/or spare debt capacity available to take up opportunities as they appear (Life Style, 2005). Slack can also be defined as the degree of freedom in a company that allows it to change (DeMarco, 2001). Lawson (2001) notes "it is important to remember why resources that are not fully committed to immediate organizational output are not only valuable, but often essential. Slack is important for organizational adaptation and innovation - two often cited requirements for organizations of the future."

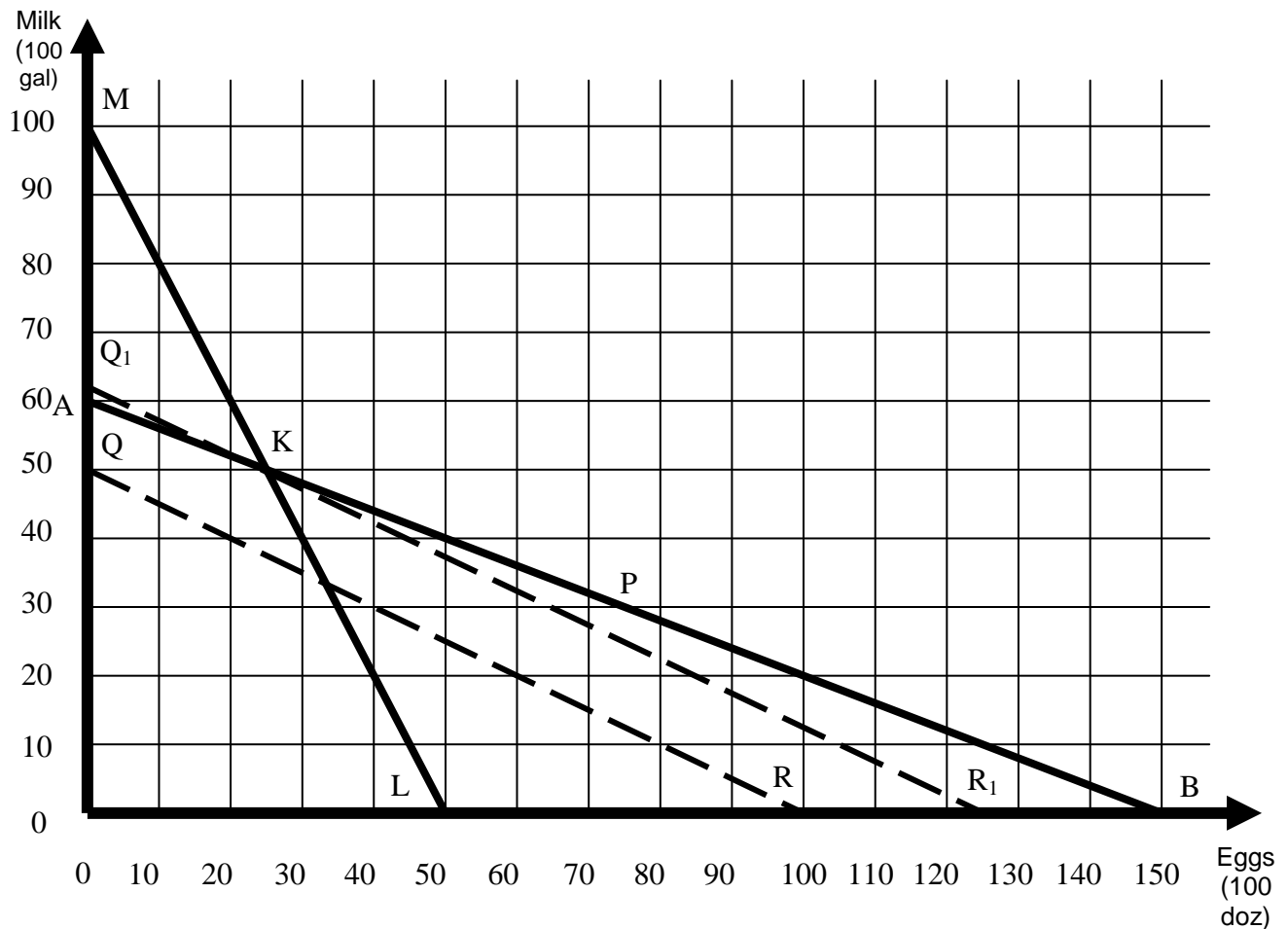
A tangentially related study by Cheng and Kesner (1997) examines whether slack resources have differential effects on the extent of a firm's response to environmental shifts. Using a sample of 30 airlines during the transitional period of industry deregulation, they found that the relationship between slack resources and the extent of a firm's environmental response is contingent on the firm's pattern of resource allocations.

Johnson (2002) cites authors Noam Wasserman, Nitin Nohria, and Bharat Anand of Harvard Business School. To wit, there are two critical dimensions that influence the magnitude of a CEO's impact on an organization, one being a function of resource slack. Yuen (2004) found that one major dimension of managerial behavior that is affected by the budgeting process is the propensity to create budgetary slack (PCBS). PCBS is still a major concern in practice currently, yet very little is known about why some firms have higher PCBS than others.

A GRAPHICAL EXPOSITION OF RESOURCE SLACK AND RISK TOLERANCE

By using a series of graphs found, respectively, in Figures 1 though 4, this paper affords a visual landscape that elucidates a fundamental aspect of business risk behavior. We employ a paradigm for a profit-maximizing firm which produces two goods (milk and eggs) and faces three resource constraints (Land, Barn Capacity, and Cool Storage Capacity). The salient feature in this paradigm is a focus on the status of resource slack at the profit-maximizing output combination. This paradigm underscores the importance of resource slack in business investment decisions and affords rigor and practicality dimensions to the study of risk tolerance.

Figure 1: Graph of Constraints



Line AB is the representation of a resource constraint, Land, which is used in the production of two products: Product X is measured on the Horizontal Axis where 1 unit = 100 Dozens of Eggs. Product Y is measured on the Vertical Axis where 1 unit = 100 Gallons of Milk. Line AB is drawn between two points: A (0, 60) and B (150, 0), assuming the format (X coordinate, Y coordinate). Using all of Land resources, one possible production combination is represented by a maximum of 60 units of Milk and zero units of Eggs, designated by point A on the Y intercept. Alternatively, a maximum of 150 units of Eggs and zero units of Milk can be produced, as designated by point B on the X intercept. Also any linear combination of the two products, say half of each, 75 units of X and 30 units of Y, can be produced and found on Line AB as depicted by point P. Similarly, 100 units of X and 20 units of Y, or 25 units of X and 50 units of Y, can be produced, and so on.

Obviously, it is possible to produce a lesser amount of one or both products. For example, 125 units of Product X and zero of Product Y can be produced; or 75 units of Product X and 25 of Product Y, and so on. Note that no combination allows for a negative value of either Product X or Product Y, because negative values in production are meaningless. Additionally, all the points located in the area above Line AB are non-feasible and all the points that fall on Line AB or below Line AB represent the feasible production combinations.

Line ML is the representation of a second resource constraint, Barn Size, which is also used in the production of the same two products, Eggs and Milk. Analogously, all points on Line ML or below Line ML represent feasible production combinations.

Imposing both resource constraints, namely Lines AB and ML, will yield the feasible area of production combinations [A K L O A]. Areas [K A M K] and [K B L K] are in the feasible region of only one resource, and the area beyond the Line [M K B] (to infinity) is not in the feasible region of either of the two resources.

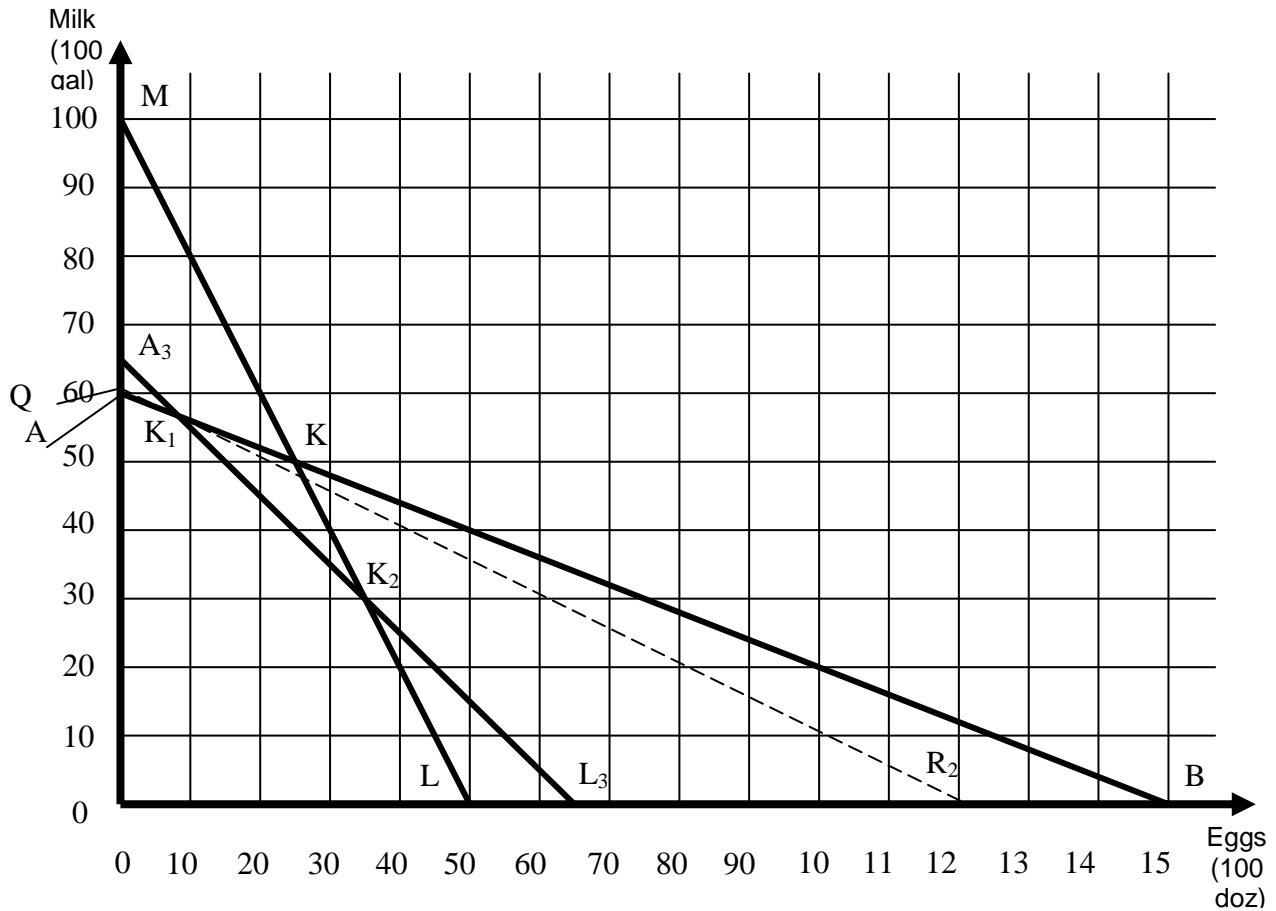
Now let's consider Line QR, which represents an Isoprofit (or Profit) Line, whereby the Total Profit corresponding to production and sale of any linear combination of the two Products X and Y is constant. In this example, Point R corresponds to the Profit derived from 100 units of Product X, and Point Q corresponds to the Profit derived from 50 units of Product Y. The slope of the Line QR is equal to $\frac{1}{2}$, which indicates that Profit from one unit of Product Y is twice of that for Product X, since Profit is constant along Line QR. Any other point on Isoprofit Line QR will produce the same Profit. For example, let us assume that Profit for one unit of Product X is \$15, and as such the Profit for one unit of Product Y will be \$30. Accordingly, the Line QR represents the line corresponding to a Profit of \$1,500. Exemplifying this:

- At point R, Profit = $100 * \$15 + 0 * \$30 = \$1,500$;
- At point Q, Profit = $0 * \$15 + 50 * \$30 = \$1,500$; and
- At the midway point between Points Q and R, Profit = $50 * \$15 + 25 * \$30 = \$1,500$.

Again, assume that Profit per unit for Product X is \$15, and Profit per unit for Product Y is \$30. Thus, any Isoprofit Lines that are parallel to Isoprofit Line QR (having the same slope equal to $\frac{1}{2}$) represent Profits higher or lower than \$1500 depending, respectively, on whether a given Profit Line is farther from or nearer to the graph's origin.

The question is: Which point in the feasible region [A K L O A] corresponds to the highest Profit, again assuming the Profit for each unit of Product Y is twice that of Product X. The answer is Line Q_1R_1 , which is the Profit Line farthest from the graph's origin yet one that cuts through a point found in the feasible region [A K L O A], namely Point K. The second question we can ask is: How much is the Profit corresponding to Line Q_1R_1 ? If we calculate Profit at point K, Profit = $25 * \$15 + 50 * \$30 = \$1,875$. In fact the same Profit of \$1,875 is derived at any point along Line Q_1R_1 , (akin to the method used earlier for calculating Profit along Profit Line QR). For example, at the X intercept, Profit = $125 * \$15 = \$1,875$, and at the Y intercept, Profit = $62.5 * \$30 = \$1,875$.

Figure 2: Constrained Optimization



The graph in Figure 2 introduces a third resource constraint, Cool Storage Capacity, designated by Line A_3L_3 . Inclusion of the new third constraint reduces the feasible production region from $[A K L O A]$ to $[A K_1 K_2 L O A]$, meaning that the area $[K K_1 K_2 K]$ will no longer be part of the feasible region. Consequently, Point K is, in turn, no longer part of the feasible area. Accordingly, the new relevant Profit Line (or Objective line in the sense that the objective is to Profit maximize) is one that is parallel to Line Q_1R_1 , but closer to the origin and which cuts through Point K_1 . This line is shown as Line Q_2R_2 . No other line, parallel to Line Q_2R_2 , could be drawn to contain at least one point in the feasible area, yet be farther away from the origin. Hence, Line Q_2R_2 represents the highest Profit attainable from production, given the constraints, production possibilities and relative Profit per Unit data.

A DIGRESSION ON GRAPH COORDINATES

A digression is useful here. The slope-intercept form equations for our three resource constraint lines are as follows:

- For land: $y = 60 - .4x$; (The slope of Line AB = $60/150 = .4$)
- For the barn: $y = 100 - 2x$; (The slope of Line ML = $100/50 = 2$)
- For cold storage: $y = 65 - 1x$; (The slope of Line $A_3L_3 = 65/65 = 1$)

The intersection between land and barn constraint lines (Point K) can be found as follows:

- $60 - .4x = 100 - 2x$; or $100 - 60 = 2x - .4x$; or $40 = 1.6x$; or $x = 40/1.6 = 25$.
- In either of the above two equations, replace x with 25, and we can arrive at the y value:
- $y = 60 - 0.4 * 25 = 60 - 10 = 50$
- $y = 100 - 2 * 25 = 100 - 50 = 50$ (confirms)
- Thus, the point of intersection for the land and barn constraint lines (Point K) is found at coordinates, $x = 25$ and $y = 50$.

To find the intersection between land and cold storage constraint lines (Point K_1):

- Setting the equations equal to each other: $60 - .4x = 65 - x$; or $.6x = 5$; or $x = 5/.6$; or $x = 8.333$
- Substituting for x : $Y = 65 - 8.333 = 56.666$
- Thus, the point of intersection for the land and cold storage constraint lines (Point K_1) is found at $x = 8.333$ and $y = 56.666$.

To find the intersection between the barn and cold storage constraints lines (Point K_2):

- Setting the equations equal to each other: $100 - 2x = 65 - x$; or $x = 35$
- Substituting for x : $y = 65 - 35 = 30$.
- Thus, the point of intersection for the barn and cold storage constraint lines (Point K_2) is found at coordinates, $x = 35$ and $y = 30$.

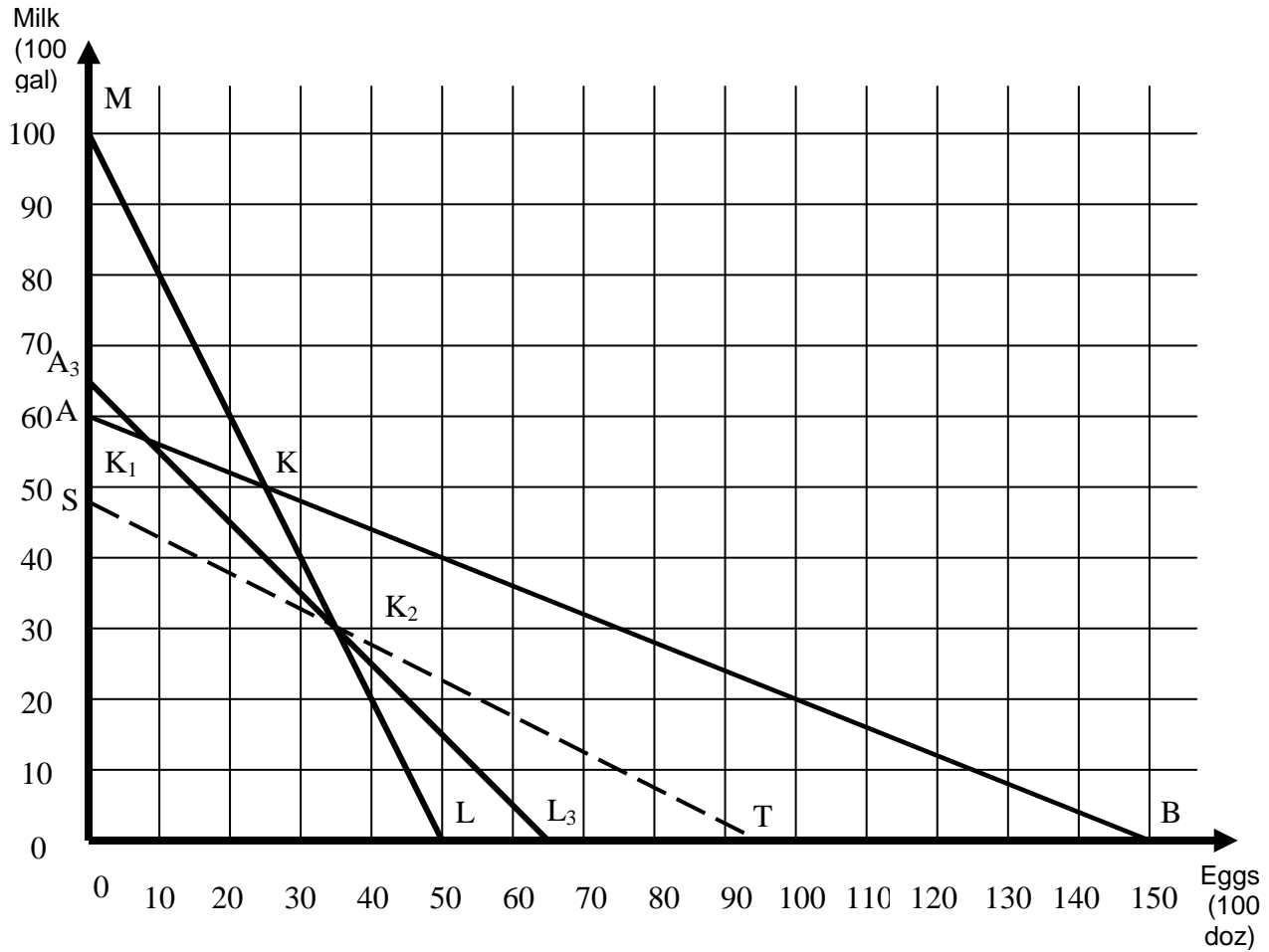
Recall the coordinates for Point K_1 , namely: $x = 8.333$ and $y = 56.666$ and that Profit per unit for Product X = \$15, and Profit per unit for Product Y = \$30. Thus, at any point along Isoprofit Line Q_2R_2 , Profit = $8.333 * \$15 + 56.666 * \$30 = \$1824.975$. Accordingly, the vertical Y Intercept for the Isoprofit Line $Q_2R_2 = \$1824.975 / \$30 = 60.8325$. Similarly, the horizontal X Intercept for the Isoprofit Line $Q_2R_2 = \$1824.975 / \$15 = 121.665$.

So far, the constraints we have imposed (resource constraints) denote maximum limitations, signifying lines that set upper bounds, i.e., production combination points beyond the boundaries were not within reach of the business. However, there are situations when the constraint indicates a minimum. For example, a lower bound may exist on output quantity in order for the product to qualify for sale at the wholesale market level. Accordingly, only points (representing production combinations of Product X and Product Y) above such a line have potential to be in the feasible region of production.

Let us assume that Line A_3L_3 which we saw in graph 2 is no longer a resource line, but instead a minimum requirement line. This (temporarily designated) minimum constraint Line A_3L_3 , along with our two original maximum resource constraints, Line ML and Line AB, would yield the feasible region $[K K_1 K_2 K]$. Put another way, feasible region $[K K_1 K_2 K]$ reveals that production can exceed neither Line AB nor Line ML, but must exceed Line A_3L_3 . In such a case, it can be imagined that an Objective Function (Profit Line) may be drawn through point K identical to Line $Q_1 R_1$ shown in graph 1 (and not shown in Figure 3), that will maximize Profit.

Had the Objective Function Line represented some variable we had wished to minimize, perhaps a business cost of some sort, the appropriate Objective Function Line would be represented by dashed Line ST and drawn through point K_2 .

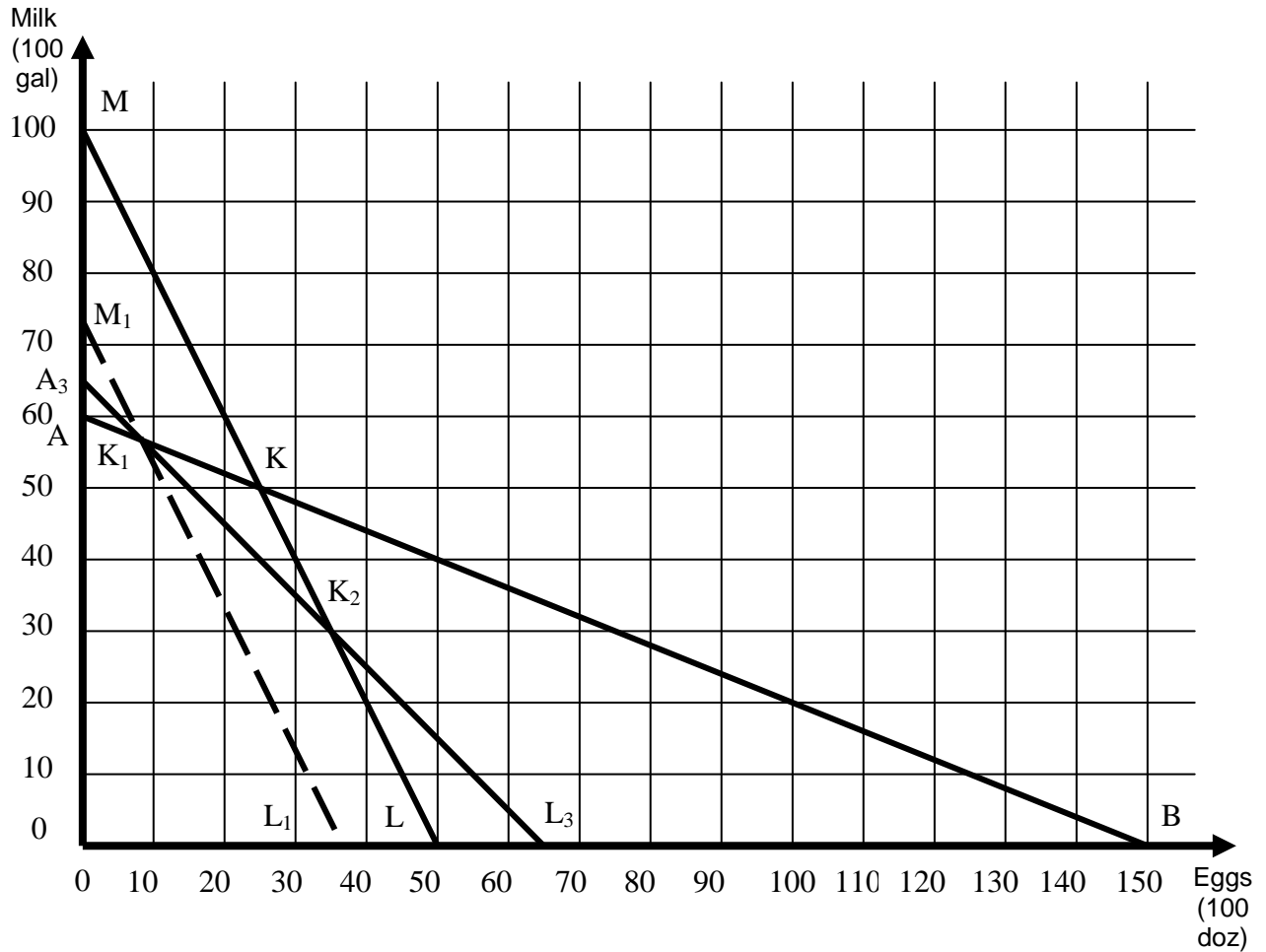
Figure 3: Profit Maximization vs. Cost Minimization



Note in Figure 2, that point K_1 , the Profit maximizing output combination, lies only on two of the three resource constraint lines; specifically, K_1 does not lie on resource constraint Line ML. This scenario indicates that the original resource line shown by Line ML could be reduced (via a parallel shift toward the origin) to that shown by the dashed Line M_1L_1 , in Figure 4, without any change in Total Profit, since Line M_1L_1 cuts through Point K_1 , the profit-maximizing output combination given all three resource constraints. To clarify further, when Profit is maximized, there will still remain enough of that resource designated by Line ML (in our example representing Barn Capacity) available to produce either L_1L more of Product X or M_1M more of Product Y (or any linear combination of the two). Obviously there are not enough of the other two resources (Land and Cold Storage Capacity) to accomplish this, meaning that some portion of the Barn Capacity resource remains unutilized at the firm's profit maximizing level of outputs (combination of milk and eggs) at Point K_1 . Enter Slack. What are the implications to the business' risk profile in light of resource slack?

Figure 4: Resource Slack

Figure 4: Resource Slack and the Investment Decision



DISCOURSE ON RISK BEHAVIORS

We preface our attempt to address the implications to the business’ risk profile in light of the aforementioned situation with a discussion of familiar germane nomenclature. Firstly, ‘Risk lover’ can be a misleading expression. A risk lover is thought of as someone who does risky things for the love of it, in and of itself, i.e., for the derived fun and excitement. An interesting study by Soane and Chmiel (2004) considers the influence of personality and decision factors, including risk perception, on domain-specific and cross-domain risk preferences.

In the business context, however, a risk lover does not take risk for its own sake, but because the risk/return tradeoff dictates that with a greater exposure to risk comes a greater possibility of payout (Beattie, 2005). Indeed, businesses assume risk based on relatively more objective and quantifiable factors. Businesses assume risk, induced by sufficiently high potential pay offs *and* when they can ‘afford’ to take the risk of losing their investment. Hence, businesses are actually ‘high potential pay off lovers’, not ‘risk lovers’. Although the newer literature more conspicuously and aptly refers to such entities as ‘risk seekers’ (see, for example, Graboves, (2005)) rather than ‘risk lovers’ (see, for example, Coricelli, Morales and Mahlstedt (2002)), or ‘risk-takers’ (see, for example, Page (2005) and Fuller (2005)), ‘high payoff seekers’ would be a more suitable moniker.

At the same time, it can hardly be denied that virtually everyone loves a high pay off, but most people cannot ‘afford’ options with high potential payoffs, because of the associated high risk of losing their initial investment. As most people cannot afford to pursue such options, there is not sufficient competition to generate lower pay offs. The contrary case was evidenced in the junk bond market in December 2004; supposedly, a combination of increasing confidence about the economy, low interest rates, and strengthening corporate balance sheets had sent investors, big and small, into junk-bond investments, raising bond prices and lowering bond yields (Lucchetti, 2004).

Now let’s contemplate the meaning of high risk. A person who spends \$1 on a lottery ticket basically takes a one in ten million chance of *not* losing the entire investment of \$1. Conversely, the odds of losing the \$1 investment are nearly 100%. Can we rightfully dub this a high risk investment? What about a person who liquidates all her assets and invests the cash in a deal which is 50% safe, with a pay off of ten times the invested money, a fantastic deal, given that a fair pay off for the 50% risk is only twice the initial investment? But should she risk becoming homeless and asset-less with a 50% likelihood? Obviously, a scrupulous answer to either scenario is premature without entertaining other aspects we are alluding to that are associated with the investor.

Let’s assume an investor is considering two casino gambling options. If she gambles on odd versus even number outcomes on the roulette table, the odds of winning are 50/50 (ignoring the money that the casino takes), and thus the pay off should be twice the investment in order to qualify as a ‘fair’ bet. Similarly, if the odds of winning are only one in ten, the pay off must be 10 times the investment to qualify as a fair bet, again ignoring what the casino takes. Whether a fair bet or not, it is how the potential loss will affect one’s utility that is relevant to risk profile analysis.

So for a person who ventures her money in a fair bet, the pay off on the average (i.e., if the person plays an infinite number of times) is zero. However, for a finite number of games played where a negative return is possible, if she is not able to take the risk of losing her investment, she is at least better off playing the odd/even game where she faces only a 50% chance of loss (and only twice the pay off). Someone who is better able to take the risk of loss can more comfortably play a casino game with a 90% chance of loss (and ten times the pay off). In both cases, it is not just the percent probability of loss or win, but how much is being invested. Vast numbers of people can invest \$1 with only a one in ten chance of winning even if they are not wealthy. Even a very poor person might ignore the disutility of losing one dollar in the very unlikely possibility of a large payoff. But relatively few persons can bet a million dollars even facing a relatively higher 50/50 chance of winning.

RISK SEEKER, RISK AVERSE AND RISK NEUTRAL TENDENCIES

Based on the above discourse (and putting aside any psychological thrill derived from assuming any given risk), one may conclude that virtually any person, company, operation, organization, etc., *up to some extent* can take the risk of losing her/his/its investment in the hope of a positive return on investment (ROI), and, thus, by definition warrant the moniker of ‘risk seeker’. From this, it follows that *beyond that extent*, the entity would be considered “risk averse”, meaning that, for such entities, any potential gain does not justify taking the risk of losing the initial investment. And *precisely to that extent*, the entity is “risk neutral”, denoting a range of risk neutrality which is basically very narrow and hypothetically equal to zero.

To further clarify, the focus with respect to the discernment of business risk behaviors is not solely the investment quanta per se but rather the *utility of gain* and the *disutility of loss* associated with the investment returns (which can range from negative to positive). If the potential loss of one’s investment, no matter how small the investment, causes significantly unfavorable results and/or if the potential gains from the investment contribute insignificantly in the aftermath, then the entity probably should not take the risk (hence, risk averse behavior). Conversely, one indeed should consider taking the risk (hence, risk seeker behavior). Somewhere in between is the neutral zone where associated utilities and disutilities are approximately equal (hence, risk neutral behavior).

As Smith (2005) relates in his course notes, “A risk-averse person has a diminishing marginal utility of income and prefers a certain income to a gamble with the same expected income. A risk lover has an increasing marginal utility of income and prefers an uncertain income to a certain income. The economic explanation of whether

an individual is risk averse or risk loving depends on the shape of the individual's utility function for wealth. Also, a person's risk aversion (or risk loving) depends on the nature of the risk involved and on the person's income."

REVISITING RESOURCE SLACK

The prior discussion concerning Figure 4 begged the question, 'What are the implications to the business' risk profile in light of this situation?' To wit, the situation is one of resource slack under conditions of profit maximization. The existence of resource slack prescribes that this resource may be allocated to virtually any venture without risking impairment to the business' operation objective, because, by definition, whether the business incurs a positive ROI or incurs a negative ROI up to the value of its resource slack, its profit-maximizing position is not compromised. Indeed, the entrepreneur could – and should – sell some slack barn space and invest the proceeds in a high risk venture, e.g., another income-generating activity such as the egnog business.

An imperfect, albeit interesting, parallel to business resource slack might be drawn from the individual household's experience with what is articulated as 'Play Money' (WSJ, January 5, 2005). Play Money is viewed as funds which, if lost in an investment, would not "impact your lifestyle or derail your family's financial plans."

CONCLUSION

If a business possesses slack (surplus) resources, meaning resources beyond those necessary to achieve an operational objective – in our analysis a level of Profit at a point of profit maximization – the value of the surplus assets can then be invested and risked without the possibility of compromising the business' objective. Graphical analysis employing three resource constraints was used to illustrate the specific amount of slack that could – and should – be risked. Indeed, in cases of resource slack, it behooves the business to allocate the value of the unused resource(s) to any risky investment venture.

In our example, the business with resource slack is appropriately designated a 'risk seeker', 'risk taker' or 'risk lover', which are expressions used synonymously in the literature (though care should be taken not to succumb to the non-technical dictionary definition of these expressions).

Risk behavior is a characteristic of the business, not of the individual who makes the business decision. Even if a business CEO typically initiates bar brawls, bungee jumps and drives at excessive highway speeds, if there are no slack resources in the CEO's profit-maximizing firm, the business effectively faces no *choice*. Thus, the business has no platform to take any risk and, accordingly, the business would not be referred to as a 'risk seeker'. By default, the business would be 'risk averse'.

Viewed from another perspective, even if the CEO is personally ascribed as a diffident, but the CEO's business has some "slack", then even that timid CEO must consider investing dollars up to the value of the slack. The business initiative and risk designation is extraneous to any personal risk appetite tendencies or disposition of the CEO.

The paradigm introduced in this paper contextualizes risk profiling in a rigorous manner which should augment treatments relayed in standard principles of finance textbooks.(See, for example, Brigham and Houston (2004)).

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