DEPARTMENT OF ECONOMICS WORKING PAPER SERIES

An Economic Perspective (Model) on US Corporations and Treasury Stock

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Working Paper No: 2014-03

April 2014

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Abstract

Treasury stock and firm market value using a modified Tobin's q are modeled by using a firm utility preference function and a quadratic constraint function. The choice of the quadratic form is based on an econometric analysis of the relationship of q to T, the amount of treasury stock held by the firm. US industrial corporations were sampled for the quarterly period from 1969 to 2013. There are 1,041 panels (firms) and some 32,494 overall observations. The statistical results were quite good. The firm's optimum solution resulted in a q that is less than the maximum q given by the inverted U-shaped constraint. I argue that stockholders would prefer the maximum q.

Keywords: Treasury Stock, Firm Market Value, Utility Preference Function
JEL Classification: C40; C33; G30

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Introduction

Treasury stock is common stock which a corporation repurchases from the pool of outstanding common stock. The reasons why a firm will repurchase its own stock are numerous (an alternative to dividends, used to stabilize its market price, used for employees' pensions and compensation, to adjust owners' equity to the firm's book value or capital, and others). The regulations covering such repurchases are also numerous, very complex and vary from state to state. Legal experts, accountants, economists, and financial experts devote their time and effort to understanding the complex system involving treasury stock, the motives for it and its consequences.

The literature on stock repurchases, particularly the financial literature, is quite large, focuses mainly on the effect of treasury stock on firm market value, uses relatively small samples, and generally does not contain an *a priori* theory (see, for example, Sabri, 2003 and Tsetsekos, Kaufman and Gitman, 1991 and the cites therein for surveys). My intent here is to put forth an, *a* priori ex ante model that shows how firm market value and treasury stock are related and behave. In effect, it will show how the firm makes its choice over market value and treasury stock (where the choice mechanism implicitly reflects the above reasons).

The immediate task then is to design a model that captures the relationship between treasury stock and firm market value. If stockholders are reluctant to sell their ownership back to the firm, then, in principle, the various motives of the firm for repurchasing its common stock will go wanting. Presumably, in economic theory, most everything has a "price", so conceivably the reluctance can be purchased. This situation is analogous to the land-owning farmer who is reluctant to sell his land at any price to the developer, for he values the benefits of ownership and control more highly than a short-run price gain.

The relationship I propose to model captures in a fairly simple way how the firm behaves, but there are a few caveats. The theoretical concepts of treasury stock and firm market value have to be identified and measured by real-world data, so adaptations have to be made. The adaptations will be considered in the design section of the paper.

In anticipation of the empirical results, what I find is that among those corporations which do have treasury stock, the relationship between treasury stock and firm market value is non-linear and particularly strictly concave. At some amount of treasury stock, typically, beyond that amount the firm market value falls. This result has important implications for management behavior as hinted at above.

In what follows, in the next section the theoretical model is designed and its operational counterpart is given. The next section discusses the sample and the statistical results. The final section summaries the paper and includes conclusions.

The Treasury Stock Model and Its Application

Modeling treasury stock is complex, since there are many reasons for its use by the corporation as the cited literature shows. In my modeling effort, I am aware of the many economic and financial factors that can affect the stock market and therefore the firm market value. The announcement of a stock repurchasing plan by a corporation is only one factor. Dividend plans are another factor. My design approach follows the literature and limits my focus on the firm's use of treasury stock to influence the market value of its common stock. So, in effect, the firm's market value is dependent on the amount of treasury stock, conditioned by other factors such as firm size (total assets) and the amount of its long-term debt.

The reverse causation is, if the market value (given by q) exogenously goes up, then, the firm, ex post, will elect to hold more treasury stock (given by T). In theory and the literature, the direct form $q = f(T, \ldots)$ is the first design. But, from a strictly econometrical perspective, the inverse $T = f(q, \ldots)$ specification may perform better. More on this later.

In any case, based on the first design, I assume a firm utility preference function given by $U(T, q)$ where I assume that the marginal utility of T (treasury stock) is negative and the marginal utility of q (market value) is positive. The reason for the negative marginal utility is to insure that the slope of the iso-utility curves for the firm is positively sloped and strictly convex. The development of the model below will show the necessity for this negative assumption. The positive slope of the iso-utility curves means that both market value (q) and treasury stock (T) move together, given the level of utility. Further, I assume a constraint function $q = f(T, Z)$, given here for simplicity by the implicit function $[q – f(T, Z)] = F(T, q, Z) = 0$, where Z represents the controls, firm size (total assets) and in effect external ownership given by long-term debt.

The Lagrangean function for optimization by the firm is given by

(1) $U(T, q) + \lambda F(T, q, Z)$.

The first-order conditions for a constrained maximum are given by

(2a) $\partial U(T, q, Z)/\partial T + \lambda\partial F(T, q, Z)/\partial T = 0$, and

(2b) $\partial U(T, q, Z)/\partial q + \lambda\partial F(T, q, Z)/\partial q = 0$.

The ratio of the two marginals after rearrangement is given by

(3) $dq/dT = -MUT/MUq = [\partial F(T, q, Z)/\partial T]/[\partial F(T, q, Z)/\partial q] > 0$.

Since I want the iso-utility curves to have a positive slope at the equilibrium point of tangency, (3) must be positive. The marginal utility of T given here by MUT is negative as indicated above, and the marginal utility of q given here by MUq is positive by assumption, so (3) is positive. The negative sign on the left side comes from the rearrangement of (2a, b) and transferring the negative sign from the ratio of the two derivatives of F(T, q, Z) to the left side. The marginals for the constraint F(T, q, Z) are both positive along the left-hand side of the inverted U-shaped F(.). This in effect is a necessary second-order condition for U(…) to be maximized.

Figure 1 below shows the iso-utility curves for the firm, labeled UF, and the inverted U-shaped constraint function F(T, q, Z). The optimal solution at tangency e will be to the left of the high point "h" on F(…). The rationale for this design is based on my reading of the literature. The firm prefers more of both q and T for a given level of utility, hence the optimum e will be to the left of “h”. Thus, q and T are complements as opposed to being substitutes (indicative of more control and value). It does not appear from the literature that the firm would view q and T as substitutes. More T satisfies the motives behind repurchasing and a higher q raises the value of management’s own personal holdings of common stock and the value of its stock options.

The model I design allows me to make a statement about stockholders’ preferences. One can argue that stockholders as a group would prefer a different optimal solution, one that is at point “h”, the maximum firm market value (see, Woodruff, Torabzadeh, and Ross, 1995, for a study on the stockholder wealth effect of stock repurchases). To depict this solution, a horizontal iso-utility curve (dotted, USF) is show in Figure 1 for the stockholders. I assume an horizontal curve partly for design purposes but also based on the assumption that either stockholders do not care about the ownership and control implications of treasury stock or because it is simply not part of their decision information set. They are by and large happy with the high market value at “h”.

The operational form of my statistical model is given by the quadratic form

(4) $q = a + b1*T + b2*T^2 + b3*Assets + b4*LTD + e$,

where e is the error term. As indicated earlier, I will use the inverse of this, namely $T = a + b1*q + b2*q^2 + b3*Assets + b4*LTD + e$, for strictly econometrical convenience. This inverse form implies that q is exogenous which is not entirely correct given the theory I advocated earlier. In any case there is some validity to this form if I recognize that the firm’s dividend plan can influence the market value, q. I do not go into the firm’s dividend policy, but I do recognize that it can be working behind the scenes, so based on that recognition I am willing also to include in the paper the statistical results of using the inverse form of the model. The optimization process will be virtually the same and the figure the same except for reversing the variables on the axes.

The Sample and Statistical Results

The useable sample (missing values dropped) consist of 32,494 observations for US industrial corporations (SIC 2000 to 3999) covering quarterly the years 1969(4) to 2013(3), all firms (about 1,041) with some treasury stock and with firm market value greater than zero. The data are from Standard & Poor's Industrial file.

The basic equation (4) is the basis for the quadratic concave constraint function in Figure 1. The market value of the firm q is defined as the ratio of the market value of common stock MVF (given by share prices as of the end of the quarter times the number of common stock shares outstanding at the end of the quarter) to the value of shareholders' book equity (labeled BE). The q is thus MVF weighted by BE. It resembles Tobin's Q and is essentially the q used in the current treasury stock literature. The treasury stock T is the number of common stock shares recorded on the balance sheet of the firm for the quarter. To repeat, only firms with a positive amount of T are used in the sample. The firm's total assets (Assets) and long-term debt (LTD) are used as control variables, affecting the market value of the firm and thus q.

The estimation method used is the cross-section/time series generalized least squares method (XTGLS in Stata) for unbalanced panel data with heteroscedastic variances. The autocorrelations (AR1) for each panel is assumed common for all panels (1,041). The panel-specific autocorrelation method did not give useful coefficient results.

The statistical results for q on T are given in the first column of Table 1. All of the coefficients with the exception of the coefficient for LTD are highly significant. The mean equation is given by $q = 2.310 + .0048*T - .0000012*T^2 - .000011*Assets + .000012*LTD$. This equation is the basis of the constraint graph in Figure 1. Its maximum q occurs at T = 2,000 (in millions of shares) with a sample mean of 25 (in millions) and a maximum of 3,617 (million). Most of the sample T's are to the left of 2,000 (million), and, therefore, on the rising part of the constraint function where the equilibrium occurs.

In column 2 of Table 1, I report the results from running the log(q) on the same variables as previously used. The log form reduces the dispersion of the sample as the much higher Wald = 289.69 shows. All the coefficients are significant, have the same signs as before, and produce essentially the same inverted U-shaped constraint function in Figure 1.

As indicated earlier, it is of some interest to run the inverse of equation (4), T on q, q squared, Assets, and LTD. The same statistical estimation method as above was used. The results are given in column 3 of Table 1, where the inverse variables are shown in parentheses. The results are quite good with all coefficients significant, a very high Wald = 200.24, and 1,041 panel-specific autocorrelations (AR1). The estimated form of the quadratic constraint function is essentially the same as before.

Any one of the three constraint function estimates is an acceptable result, although the fit (given by Wald) is better for the log(q) form and the inverse form. In any case, the inverted U-shaped constraint function serves my purpose. For the hypothesized utility function, an optimal equilibrium will occur to the left of the high point on the constraint. Of course, how far to the left of the high point "h" in Figure 1 the equilibrium may be is a matter of conjecture and from a design viewpoint will depend on the actual specification of the utility function. The iso-utility curves could be somewhat flat so the optimum solution would be close to the high point on the constraint.

Summary and Conclusions

A model was designed using fairly straight forward economic tools to show how the firm chooses its optimal combination of treasury stock and firm market value. The statistical results suggest that the constraint function be a strictly concave quadratic function. With this function and the firm's utility function, an optimum was shown. I also showed that the model can be used to show the stockholders' preferred solution, which from our model is quite different from that of the firm. As a result of that difference, a Principal-Agent problem can emerge (see, Fama and French, 2001, among others).

As indicated at the outset, the literature does address the specific problems that can arise with treasury stock repurchases. My limited task was to design an *a priori* model to show how the firm would behave with respect to one of these problems, the relationship of treasury stock to firm market value.

*Acknowledgement: I wish to thank my colleague, Professor Korkut Ertürk,, for valuable comments on the initial phase of the paper. Of course, he is not responsible for any errors that may exist.

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Table 1. Statistical Results for q on T Using the XTGLS Method

Variables	Basic Eq(4)	Log(q) Eq(4)	Inverse Eq(4)
Constant	2.310 (48.46)	.74 (82.79)	2.90 (127.21)
T(q)	.0048 (7.33)	.0015 (15.96)	.0013 (4.30)
$T^2(q^2)$	-1.19e-06 (-5.18)	-4.00e-07 (-12.56)	-1.61e-07 (-2.81)
Assets	-.00001 (-3.79)	-1.55e-06 (-3.50)	.0004 (10.09)
LTD	.00001 (1.31)*	1.99e-06 (1.65)	-.00014 (-1.94)
Wald(4 df) p	56.71 .0000	289.69 .0000	200.24 .0000

Notes: Sample size is 32,494 obs and 1,041 firms. The * indicates not significant with p >.10. The inverse Eq(4) has T on (q), (q^2), Assets, and LTD. The z ratio is in (.).

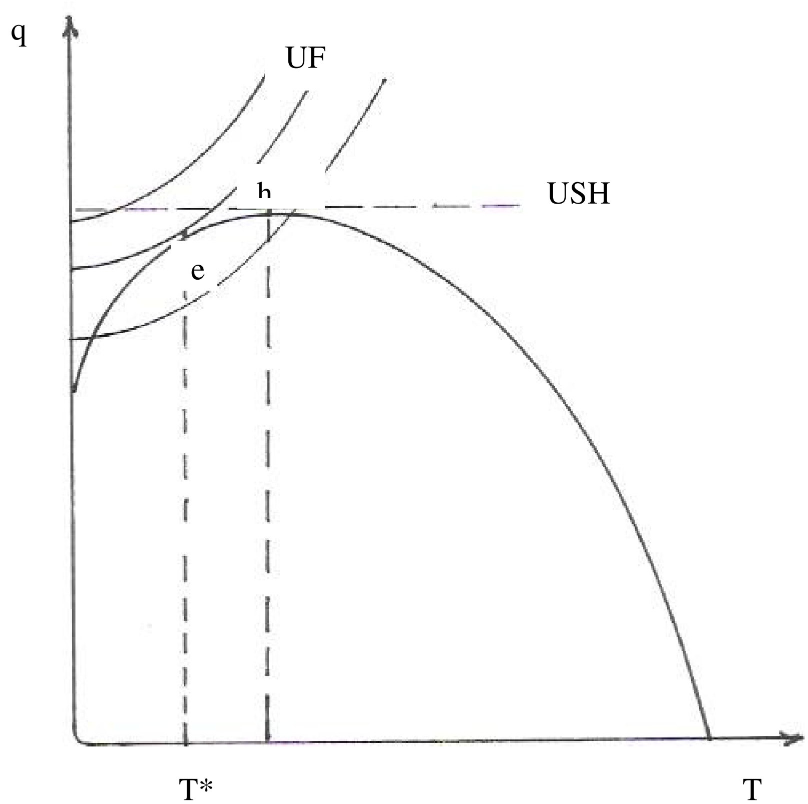

Fig. 1: Optimization Choices for Firm and Stockholders