Discussion of
"The Stock Market and Investment in the New Economy:
Some Tangible Facts and Intangible Fictions"
By Janice Eberly

Since 1995 the S&P 500 Index has risen by a factor of three, or about 25 percent per year. As impressive as this performance is, it is modest in comparison to the seven-fold, or 45 percent per year, increase logged by the S&P High Technology Index.[1] This astounding performance suggests to many that there is an asset bubble in equity markets. Alternatively, the value of intangible capital may have risen substantially, accounting for at least part of the spectacular increase in firms' market values, particularly in the "New Economy" sectors.

Bond and Cummins attempt to sort out these two explanations empirically. This is an admirable and difficult task, since both the market values of intangible assets and asset bubbles are not directly observable. Lacking direct measures, the authors construct a model and proxies for the desired data and argue that intangible and bubble effects can be inferred.

The starting point of Bond and Cummins' argument is a measure of firms' value based on analysts' earning forecasts. This is used to construct a measure of average q based on expected earnings, rather than markets' valuation of those earnings. In order to tackle the issue of unobserved intangible capital, the authors then set up a model allowing them to use only investment, rather than the stock, of intangibles. They estimate this model as a linear regression of physical capital investment on their constructed measure of fundamentals and intangible investment. An asset-based measure of fundamentals, Tobin's q, is added to this regression as a diagnostic: if the "fundamental measure" is correctly capturing investment incentives, then any additional value in Tobin's q is simply "noise" or a bubble.[2] Such a bubble, they argue, should not affect investment and therefore should not be significant in the regression. The final test is to analyze "New Economy" firms separately. Even if the measure of intangibles is not perfect or does not apply to all firms, then by dividing the sample, it should be possible to ascertain if intangibles are relatively more important in the New Economy.

Based on this empirical strategy, the paper finds that the asset-based measure of Tobin's q does not provide incremental information in the investment equation, and that the effect of intangibles in these equations is modest – in both the Old and New Economy firms. The paper concludes that the intangible explanation for equity prices is a "fiction", and that equity prices instead contain a large bubble component – "Noisy Share Prices" – that is pervasive across firms and industries and over time.

There are four critical ingredients necessary to reaching these conclusions: the measure of fundamentals, the use of the investment equation to identify the fundamental part of the firm, the measure and specification of the effects of intangibles, and the identification of the New Economy. Each of these links deserves careful attention.

The measure of fundamentals

Bond and Cummins use data from equity analysts who forecast earnings at the firm level. They have two years of earnings forecasts, plus a projected "long run" growth rate intended to go

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[1] As of March 2000. Source: Bloomberg.
[2] Bond and Cummins refer to the deviation of Tobin's q from fundamentals as their "Noisy Share Price" model. I will refer to this deviation as a "bubble" in order to clearly distinguish it from white noise or classical measurement error, since it is assumed in the paper to be persistent.

out to year five. In order to calculate a firm value based on these three pieces of data, the authors have to make a number of assumptions. For example, they assume that earnings after year 5 will grow at a fixed economy-wide rate of 6 percent, and they discount the earnings of all firms at the same rate. This common discount rate is the current year long-term Treasury bond rate plus a constant risk adjustment of 8%. Thus, all firms implicitly have a beta of one and assume a fixed interest rate over a five-year horizon.   In addition, by discounting forecasted earnings rather than cash flows, the valuation mistakenly includes depreciation expenditures and excludes investment expenditures.

While all of these measurement problems would be likely culprits if the resulting valuation were not empirically relevant, the results suggest instead that it is strongly associated with investment. Moreover, this finding is robust to the inclusion of Tobin's q measured with asset prices, which has little marginal empirical impact. I found this to be the most intriguing result of the paper. While in a formal sense it is consistent with a q model of optimal investment, it is also clearly at odds with the original asset-market rationale of Brainard and Tobin (1968).

The response of investment to a bubble

The link from these very interesting investment equations to valuations comes from the assumption that investment should only respond to the fundamental part of valuation. There is a serious unresolved question, however, of how investment should respond to a bubble in asset prices.

Blanchard, Rhee, and Summers (1993) considered this question in a closely related paper using aggregate data. An optimizing firm may respond to a positive bubble by issuing equity, and thus take advantage of this cheaper source of financing. Then, however, the firm must consider the signal it sends to investors by its use of these funds. Investing the proceeds of an equity issue in safe securities, while preserving the path of the capital stock, may burst the bubble, if it exists. Thus, a firm may consider investing in physical capital even though this distorts its capital choice.   In this case, one would expect investment to respond to the non-fundamental part of valuation, as well as the fundamental. More generally, an asset bubble may not be independent of the actions of the firm, and vice versa. Thus, physical investment cannot serve as a reliable identification device for asset bubbles based on current theory.   Investment may respond to bubbles, and conversely, the part of valuation not driving investment need not be a bubble, as I discuss below.

The empirical specification of intangibles

The measure of intangibles and their inclusion in the investment equation is a critical component of the paper's argument that intangibles cannot explain the high values of Tobin's q. Since the market value of intangible capital is not observed, the authors take a two-step strategy. First, they make modeling assumptions such that it is only necessary to observe the flow (investment) rather than the stock of intangible capital. Second, they measure the flow of intangible capital as a firm's advertising expenditures and R&D expenses.

Regarding the modeling, the initial framework is a standard linearly homogenous, quadratic adjustment cost model. This motivates the basic investment regression using Tobin's q. The "New Economy Model" is a two-capital version, which is also standard in the literature. However, empirical implementation of this model would require unavailable data on the stock of intangible capital. Therefore, the authors assume that for each firm, the stock of intangible capital is proportional to the stock of physical capital; the prices of the two types of capital are

also assumed to be proportional to each other. This assumption is very strong and lacks both theoretical and empirical justification. In their model, stocks of capital are endogenous variables; thus if the two stocks are to be proportional, the model must have a particular form. For example, if there are no adjustment costs on intangible capital, then in the linearly homogeneous framework, it will track physical capital, as required by the proportionality assumption. However, if there are no adjustment costs on intangibles (the parameter b_2 is zero) then intangibles do not appear in the investment equation for physical capital (equation (24)), which is the main estimation equation. Moreover, if intangible and physical capital values are proportional, then the "New Economy" story cannot explain a "persistent … increase in the market valuation of companies relative to their fundamental value" (from the conclusion) by construction. This requires a source of value that is growing relative to physical capital. By assuming that the two are proportional, the authors have assumed that intangibles are not the explanation.

Once the assumption has been made, the next step in implementation is to measure investment in intangibles. The paper uses expenditures on advertising and in R&D. These are prime example of intangible assets, but of course not the only candidates. Proponents of the New Economy would consider much of their customer service work force, marketing, and other "investments" in market share to be investment in intangible capital. It is understandably difficult for the authors to include these other intangibles in their estimation. However, the limited scope of advertising and R&D may explain their modest empirical success, rather than a more general failure of the intangible capital explanation.

What is the New Economy – and is it in these data?

While it is difficult to define precisely the "New Economy" of the paper's title, it is not clear that this approach completely captures and explores what is meant by this concept. Consider for example two prominent New Economy firms. Yahoo! had sales in 1998 of $200 million – an increase of almost a factor of three from $70 million the previous year. Its expenditures on sales and marketing in 1998 were $90 million, yet its investment in physical capital was only $8 million. This paper attempts to understand Yahoo!'s price-earnings ratio of 420 by looking at the $8 million physical capital investment, which seems rather like the proverbial tail wagging the dog. While Yahoo! is a particularly weightless firm, a similar picture emerges from looking at Dell Computer. Dell's 1999 revenues were over $18 billion. Physical capital investment was less than $700 million or less than 4 percent of revenue – in fact, quite similar to Yahoo!. R&D expenditures were less than half of investment expenditures.[3]

Less anecdotally, the authors can use the physical capital investment equation to infer the presence of intangible capital because they assume a linearly homogenous value function. This is a common assumption in the investment literature, but in this case the results are quite sensitive to it. In a standard formulation the value of the firm is $V(K_1, K_2)$ where K_1 and K_2 are tangible and intangible capital, respectively.[4] The derivative of the value function with respect to tangible capital, $V_{K_1}(K_1, K_2)$, gives the marginal value of an additional unit of capital. This marginal value determines investment in physical capital, so the investment equation depends on both types of capital. Suppose instead that another part of the firm's value depends only on intangibles. In this case the total value of the firm could be defined as $W(K_1, K_2) = V(K_1, K_2) + v(K_2)$. In this case, tangible investment should only respond to $V_{K_1}(K_1, K_2)$, and could have an

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[3] Source: Company financial reports.
[4] This suppresses the dependence of the value function on the productivity shock.

arbitrarily small response (even zero) to intangibles in the investment equation; the strength of this effect depends on the importance of K_2 in $V(.)$. Nonetheless, intangibles could account for a large part or even most of the firm's value -- through the second term $v(K_2)$. This paper finds that investment in physical capital interacts only modestly with investment in intangibles, but only under very specific assumptions does this rule out a role for intangibles (or other capital) in valuation. Intangibles may have a modest (or even no) effect on physical investment, while still having an arbitrarily large effect on the firm's valuation.

Finally, the paper's last sections compare the results for intangible-intensive firms and for "New Economy" firms to the results for the whole sample. Such benchmark observations, however, are limited in both the time series and the cross section. First, the "New Economy" is a relatively recent phenomenon, so the estimation period (1986 to 1998) includes at best a limited sample of these observations. In the cross section, firms are labeled "New Economy" if they are in particular sectors, while they are intangible-intensive if they have advertising expenditures or R&D expenditures. However, a large number of New Economy firms are ruled out by the sample selection criterion. Firms must have four years of Compustat data and be followed by an equity analyst to even be included in the sample. Thus, the two examples given above - Yahoo! and Dell - are excluded. Moreover, all of the firms in the Chicago Board Option Exchange (CBOE) Internet Index are excluded from the sample, as are all of the firms in the Dow Jones e-Commerce Index. Looking more broadly at technology firms, the sample includes only 12 of the 30 firms in the CBOE Technology Index, or even more broadly, 23 of the 71 firms in the S&P High Tech Composite. This relatively slim coverage of the most relevant firms suggests that general conclusions should be cautiously interpreted.

Conclusion

This paper explores one of the most provocative issues in current financial markets – are equities overvalued or can the valuations be justified by increasing amounts of intangible capital? Since both intangibles and excess valuations are difficult to observe, this is quite a challenging question. Bond and Cummins address this problem with two sorts of resources. First, they bring additional data in the form of analyst's earning forecasts. Second, they impose sufficient assumptions so that intangible capital is measured using expenditures on advertising and R&D. Bringing additional data is typically a most fruitful way of addressing measurement problems, and that is the case here. This effort raises some interesting questions about the information content of earnings forecasts and asset prices; these results will likely spawn future work to understand these implications. The second part of the effort, specifying and measuring the role of intangible capital, is more tenuous. A series of assumptions are necessary to go from the investment equations to general conclusions about asset market bubbles and the role of intangibles in valuation. In this way the New Economy and asset values largely escape from the authors' sights, yet leave some interesting findings about corporate investment behavior.

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