Accounting Errors

Errors of Accounting[1]

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April 2010

[1]For presentation at Bocconi University. Incomplete draft. Please do not quote.
Presidential lecture, American Accounting Association's meeting 2009, New York

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[3] Helpful comments from Joel Demski are grateful acknowledged.

Endogenous accounting errors

Accounting is obsessed with getting the means correct both when it comes to costing and when it comes to valuation. There is an emphasis of getting the numbers right such that the cost calculation or the accounting valuation hits the mean. This might be falling short of the purpose of accounting in providing information for the users of accounting statements. Information economics has taught us that only when the prior expectations are updated we learn something and that means we have an information system. Accounting errors are important in this as we only update our priors when we observe non-zero errors. The magnitude of the updating depends upon the relative variance of the observed error. In some sense is the best accounting system an information system that is best at providing informative errors. The overly concern for getting the mean correct leads us astray.

The accounting system is a closely managed information system. Financial data of the firm are collected with the purpose of guiding decisions related to the firm. The recognition rules govern the inclusion of information in the accounting library. The recognition rule also governs the exclusion of data from the accounting system. The accounting system is based upon old technology dated back to Pacioli (1494) and this technology continues to be used and the market has proved it useful. Basically it is a double entry system that simultaneously keeps track of the financial stocks and flows of the company. The comparative advantage of the accounting system is that it is hard to manipulate. The accountants have a long track record in maintaining the accounting system based upon financial data.

Even with this effort put into the construction of the accounting system, the system is by no means flawless. The net result is that not all information of relevance for economic decisions is included into the accounting system. The accounting system is effectively limited to information which can be measured reliably. Thus all troublesome items are carefully excluded. As a consequence the accounting system steps back from the valuation of many intangible assets and write investment in intangible assets off at acquisition.

Costing and the managerial accounting system also contain many endogenous errors. Most of these might originate from the discrepancy between the accounting model and the underlying economics of the firm. The old variable cost versus fixed cost controversy might be seen as belonging to this type of error. Nobody disputes the fact that marginal cost is the costing notion

which is useful for short term decisions. One of the problems associated with fixed/variable costing is that the perfect decomposition of cost into these two components is not given in the accounting system and a sensitivity analysis might then induce the decision maker to include both components of the cost into the analysis.

The bigger picture of this is that the accounting model is linear where as the world is hardly linear. Economics of scale and scope is part of most business and certainly it forms the basis for most multi-product firms. This induces errors into the accounting system and its use for decision purposes. The ABC accounting system offers a fine tuned system which mirrors the production technology of the firm but using a linear cost technique. The alternative is a simple accounting system using fewer cost drivers. Both are infected by errors and it is argued that the choice is not uniquely favoring the complex system.

Another set of errors of the accounting system relates to the fact that accounting is constructed as if it is the only information source that provides information to the decision makers. Thus much effort is put into assuring that the accounting system reflects all available information. The fair value debate reflects this. The point to be advanced here is that the accounting system is not necessarily the best aggregator of firm information. The accounting system has a comparative advantage in providing information about the financial transactions of the firm. Market related information might also get to the decision makers through other channels such as the pricing mechanism. In fact the market mechanism is a powerful information aggregator as suggested by Roll (1984). Thus there is a horse race between having the accounting system or the market mechanism perform the aggregation of market information. When this aggregation is performed by the accounting system this will potentially be less efficient in providing the transaction based information. As both types of information are in demand there is a conflict. This is discussed in the final section of the paper.

The information perspective

Accounting is providing information to decision makers. It produces numbers that have proven useful in pricing commodities and it produces data which serves as input into the managerial performance evaluation exercise. Thus the accounting serves the decision and control purposes

of accounting. Information is a key here. Information is only useful in the presence of uncertainly and then information is used to update the beliefs of the decision maker.

Bayes taught us how our beliefs are updated once new information arrives at the scene. The event of interest is called A and the new piece of information is denoted y. The beliefs of the decision maker are encoded in the probability distribution P. Bayes formula shows that the updated probabilities reflect the relative likelihood of y when y has occurred.

$$P(A|y) = \frac{P(A \bigcap y)}{P(y)}$$

More insight might be obtained when this is put in a normal distribution framework. The value of the object in question is x. This is normal distributed with mean μ and variance σ^2. The new information signal is y which is normal with mean x and variance σ_2^2. Consistent updating the expectation of x given the information in y results in the following:

$$\begin{aligned} x &\sim N(\mu, \sigma^2) \quad \text{- value} \\ y &\sim N(x, \sigma_2^2) \quad \text{- information} \\ E\left[x|y\right] &= \mu + \frac{\sigma^2}{\sigma^2 + \sigma_2^2}(y - \mu) \end{aligned}$$

The updated expectation depends both on y and the prior mean μ, this is as expected. The interesting observation is that the updated expectation of x depends also on the variances. The amount of updating depends upon the relative variance of the new information compared to the prior variance. If the new source of information has very little variance – reliable information – then the updated variance is equal to the signal. When the signal is of lower quality the updating reflects this as the updating is a decreasing function of the variance σ_2^2.

The updated expectation furthermore includes the a priori expectation expressed in μ. The update is linear in the new information signal.

The implication of this for an accounting context can be shown in a simple setting, cf. Christensen and Demski (2003). Suppose that the firm has a lifetime of three periods and faces perfect capital markets with an interest rate of r. Initially the owners invest $-CF_0 > 0$. This generates uncertain cash flows over the following three periods of

$$CF_1 = \overline{c}_1 + \varepsilon + \varepsilon_1$$
$$CF_2 = \overline{c}_2 + \theta\varepsilon + \varepsilon_2$$
$$CF_3 = \overline{c}_3 + \gamma\varepsilon + \varepsilon_3$$

The expected value of all the error terms $\varepsilon, \varepsilon_1, \varepsilon_2,$ and ε_3 are zero and the expected net present value of the investment is also zero. All the error terms are independent and that implies that the ε_i's are transitory earnings components where as ε has a permanent consequence as it affects all three periods.

The risk neutral value of the firm is given at time 0 (Value = - CF_0) and time 3 (Value = 0). The interesting valuation question are found at t = 1 and 2. Suppose only cash flows are observed by the market participants as time progresses. Given efficiency of markets the market valuation at time 1 will be

$$E[PV_1 \left| CF_1 = \overline{c}_1 + \varepsilon + \varepsilon_1 \right.] = E[CF_2 \left| \varepsilon + \varepsilon_1 \right.](1+r)^{-1} + E[CF_3 \left| \varepsilon + \varepsilon_1 \right.](1+r)^{-2}$$
$$= (\overline{c}_2 + \theta E[\varepsilon \left| \varepsilon + \varepsilon_1 \right.])(1+r)^{-1} + (\overline{c}_3 + \gamma E[\varepsilon \left| \varepsilon + \varepsilon_1 \right.])(1+r)^{-2}$$

The interesting part of this valuation expression is the expected value of permanent shock term. Bayesian updating is important. More importantly, the error terms are providing the information and the auto correlation of the error terms are the ones that make accounting interesting. Only the permanent component of the error term enters the value calculation.

Accounting valuation and income measurement is different from market valuation as it reflects accounting conventions and recognition rules. The accounting system will also reflect the first period error term, but differently. When historical cost is used the accounting valuation will start from the book value (= acquisition value) and then use periodic depreciations to adjust the value. The depreciation charge is the predetermined to δ_1. The first period accounting value is then $A_1 = A_0 - \delta_1$ and the period 1 accounting income will be $I_1 = CF_1 - \delta_1$. The income reflects the error terms. The difference between the accounting valuation and the market valuation is to be found in the expected income measures of periods 2 and 3 as in Feltham and Ohlson (1995). The future residual income measures will counter balance the error made in the accounting valuation. The calculation runs as follows.

$$E[PV_1 \left| \varepsilon + \varepsilon_1 \right.] = A_1 + E[I_2 - rA_1 \left| \varepsilon + \varepsilon_1 \right.](1+r)^{-1} + E[I_3 - rA_2 \left| \varepsilon + \varepsilon_1 \right.](1+r)^{-2}$$

The point in this is that the accounting valuation seldom coincides with the market valuation. The recognition rules of accounting dictate a more conservation information processing compared to the market valuation. When pricing the securities in a risk free market the market participants are using their information to estimate the mean value and are not constrained by accounting conventions.

When the market valuation and the accounting valuation are based upon the same information set it is possible to find the market valuation from the accounting valuation and here it is important to extract the information about the permanent error term from the income. The above analysis suggests that an important role of the accounting system is to provide information about the error terms and yet how to fulfill that role is not predominant in the accounting literature.

When the market valuation is based upon more information than the information contained in the accounting reports it becomes harder to analyze the role of the accounting information. The errors are important as suggested by Bayesian updating but the question remains as to whether the accounting information should be confined to transaction information or whether market information should be part of the accounting system. I will return to that question in a subsequent section. First the attention will be given to costing issues and errors.

Costing

Analysis of errors has long been an important part of the accounting tradition as variance analysis has a section in all accounting textbooks. The variance analysis uses a linear decomposition of the actual cost into components known as price, quantity, efficiency and spending variances. The underlying assumption of the cost structure is never stated but implicitly it is assumed linear.

Costing is an old art of accountants and the activity based costing literature has given a new interest, cf. Christensen and Demski (1995). One of the important insights which is reflected in the activity based accounting system is that the accounting structure reflects the structure of production. This way the activity based costing is better able to produce product costs which are in line with the underlying cost structure of the firm. The basic activity based construction of product cost is a two stage linear cost allocation. The errors of activity based costing have been the subject of much research. This accounting system is not flawless like most other systems.

Decisions regarding products use the marginal cost or incremental cost. According to economics this is the statistic which will guide the optimal decisions when confronted with the marginal revenue. This might take on many disguises but the lesson from economics is clear that marginal cost is the decision relevant cost statistic. Cost functions are often non-linear as increasing or decreasing returns to scale is commonplace and often this is seen to be the reason for a particular size of an operation.

Accounting cost usually assumes a linearity of the cost function. The accounting construction of unit cost is an estimation using the total cost divided by the amount produced. In a variable costing environment only the variable costs enter this calculation. In a full costing system both fixed and variable costs are included. In both cases endogenous errors in the accounting system is the result. A simple model describes the effect of such errors using a quadratic cost function.

$$\begin{aligned} C(q) &= f(q) = aq^2 \\ MC(q) &= f'(q) = 2aq \\ UC(q) &= \frac{f(q)}{q} = aq \end{aligned} \tag{1}$$

When the cost function is quadratic (1) the unit cost is half the marginal cost. The illustration makes it evident that the unit costing derived by averaging of realized cost will not be equal to marginal cost in general when the cost function is non-linear. In case of decreasing returns to scale the unit cost is always below the marginal cost and higher in case of increasing returns to scale.

Next extend this to an ABC system as in Christensen and Demski (1997). The facility produces several products in quantities described by the vector q. Assume that there are three indirect cost pools, named after the production function f, g and h. Cost pool f uses the inputs x_1 and $x_5$to produce the products in the quantity q. The products use the output from the cost pool in a Leontief technology described by A_1. This means that there is a linear use of the resources produced by f. This way A_1illustrates the cost driver for pool one as each unit of the first product uses the number represented by the first element of A_1 of the resource f. Cost pool g is similar to cost pool f. Cost pool h is an indirect cost pool. The output of h is also Leontief as it produces the input x_5 and x_6 which are used as inputs in f and g respectively. The production function of h uses the inputs x_3 and x_4. The production functions f, g and h describe the transformation process of inputs to outputs for each of the cost pools. In addition to these cost pools there are labor cost, L and material cost, M. These two cost categories are by default linear.

The cost function of the operation is found through the following optimization.

$$
\begin{aligned}
& c(q) = Min[Lq + Mq + \sum_{i=1}^{4} p_i x_i] \\
& st \\
& A_1 q \le f(x_1, x_5) \\
& A_2 q \le g(x_2, x_6) \\
& x_5 + x_6 \le h(x_3, x_4)
\end{aligned}
\tag{2}
$$

The marginal cost is the relevant cost statistic for incremental decisions. The Lagrange multipliers on the constraints are useful in characterizing the marginal cost.

$$
MC_i(q) = L_i + M_i + \lambda_1(q) A_{1i} + \lambda_2(q) A_{2i} \tag{3}
$$

There is a linear relationship between the marginal costs for the products and the Leontief coefficients fully capture the differences of the products marginal costs. It is noteworthy that the indirect cost pool is not present in this marginal cost and is accounted for indirectly through the direct cost pools. The marginal cost construction is not necessarily linear in the products q. That depends upon the production functions f, g, and h.

The cost calculations are supposedly of the ABC type and uses the costs accumulated in the three cost pools. The costs are exactly as suggested by the cost functions. First, the indirect cost pool is allocated to the direct cost pools using the available cost drivers describing the activity of this cost pool. Secondly, the total cost in the direct cost pools are allocated to the cost objects using the Leontief coefficients of the production functions. These will form the natural and available cost drivers. The calculations are summarized as shown in equation.

$$
\begin{aligned}
& C_h = p_3 x_3 + p_4 x_4 \\
& C_f = \frac{p_1 x_1 + \dfrac{x_5}{x_5 + x_6} C_h}{A_1 q} \\
& C_g = \frac{p_2 x_2 + \dfrac{x_6}{x_5 + x_6} C_h}{A_2 q} \\
& C_i = L_i + M_i + A_{1i} C_f + A_{2i} C_g
\end{aligned}
\tag{4}
$$

It is noteworthy that the coefficients of the ABC calculation are identical to the coefficients used in the marginal cost calculation. The differences among the products with respect to cost structure are precisely reflected in the ABC costing system. This is due to the Leontief structure of the production function. Furthermore, any discrepancy between ABC cost and marginal cost must be found in the Lagrange multipliers, which represents the marginal costs of the cost pools. As noted the multipliers indirectly accounts for the cost of the indirect cost pool like the ABC system. When the production functions f, g, and h are all linear the ABC costing approach will result in the marginal cost for all of the products simultaneously. If one or all of f, g, and h deviates from linearity the ABC system will not provide the marginal cost of the products.

The findings from the simple case in fact carry over to the ABC setting. When one or more of the production functions show increasing returns to scale the ABC costing system will estimate the marginal cost too high where as the opposite is the case for decreasing returns to scale.

When the underlying cost structure deviates from linearity there is the possibility that a less advanced and less complicated accounting system will dominate the ABC type accounting system. The traditional accounting system is seen as a single cost pool system using direct labor as the cost driver. The product cost calculation follows the following pattern.

$$\begin{aligned} C_L &= \frac{p_1 x_1 + p_2 x_2 + p_3 x_3 + p_4 x_4}{Lq} \\ C_i &= L_i(1 + C_L) + M_i \end{aligned} \tag{5}$$

This costing system is simpler than the ABC system as it has only one independent parameter to describe the differences of the product cost of the products in q. The input of Labor, L, is the only source of assigning the overhead costs to the products.

However as the ABC system also is an approximation it is worthwhile to run the horserace between the two systems as in Christensen and Demski (1997). The actual marginal cost of the products is used to evaluate the performance of the two accounting systems. The performance of an accounting system is measured by the mean squared error of the unit cost reported by the accounting system. They found that the traditional accounting system based solely on labor input for some combinations of the production functions outperformed the more refined ABC system. The picture is more pronounced when the individual products are evaluated. For some product one accounting

system performs best where as for another product the other accounting system performs best. There is no uniform winner of the contest.

When the production functions are restricted to linear production functions Datar and Gupta (1994) have found similar results. They also used the Euclidean distance measure to measure the performance of the accounting systems. In a simple linear setting they studied the combined effect of erroneous choice of cost driver combined with different levels of aggregation. They found that the two factors interact such that a system which repairs the system on one dimension does not necessarily lead to an improved system. Labro and Vanhoucke (2008) took the analysis one step further. They have set up a large simulation. The underlying economics of the firm is linear and with a multi layer system like an ABC system. There are a large number of cost pools which are allocated to activity cost pools and further to cost objects. All the allocations are linear using pre-specified cost drivers. In the experiment Labro and Vanhocke varied the number of cost pools both at the resource cost pool level and the activity cost pool level. Furthermore they varied the cost drivers used in the cost allocations. The result of the experiment supported the findings of Datar and Gupta as there are interaction effects between errors.

This is not only the Euclidean metric that provides this type of results. Suppose the accounting system is used for cost reimbursement. This might be part of a supply chain or it might be internal pricing of services rendered to other divisions of the firm. The pricing is assumed to be based upon cost allocation. The economic relationships in the division are as described in equation (2). It is assumed that part of the production from his division is sold for profit in the market and part of the production is delivered to other divisions in return for cost reimbursement. The cost reimbursement is based upon the realized costs as measured by the accounting system.

The question is whether the accounting system promotes efficiency as the decisions for making operating decisions are decentralized to the divisions. The idea for the producing division is if is able to pass excessive cost on the other division and through that end up showing a higher profit on its own accounts. The control system somehow prevents this from happening to a too large degree. This has been analyzed by Christensen and Demski (2003). The comparison is done between a labor cost based allocation system and an activity based activity accounting system. The production technology somehow suggests an activity based system. They found that when the technology exhibits constant returns to scale then the ABC type accounting system will always induce efficiency. Also when the direct cost pools has decreasing returns to scale there is no inefficiency

induced. However, if the direct cost pools show increasing returns to scale or if the indirect cost pool has non constant returns to scale it is possible for the division to profit from using resources inefficiently. The inefficiency is then passed on to the other division via the cost allocation. The scheme relies heavily on substitution of factors of production. This allows the division to employ the more productive resources for the products sold for profit whereas the less productive inputs are used for the internal transfers. The scheme also relies heavily on the control system of the firm. The degree to which it is possible to pass on inefficiencies is important and outside the cost allocation scheme. If labor is used to allocate cost and if it is possible to use too much labor to the internal division then they get a larger share of the indirect cost. The control system might put a limit on such inefficiency. Similarly, when activities are used to allocate cost the source of inefficiency is the use of the productive resources. The control system might also put a cap on that. Therefore an important part of the horse race between the two accounting systems is the control system which puts limits on the inefficiencies of the two systems.

The accounting system provides a model of the economics of the firm and uses that to present the economics of the firm. Accounting provides a mapping/illustration of the economics of the firm. The accounting model has many parameters and just selecting the model to mirror the structure of the firm is too simplistic. The underlying economics play a crucial role. The other dimension is the control system which might result in one seemingly inferior accounting model winning the horse race against a more refined accounting model.

Alternative information sources

Traditionally accounting has been based upon historical cost and revenue measure. Only historical information or realized cash flows could penetrate the recognition rules of accounting. The accruals also have a historical orientation but contain certain forward looking elements. The valuation of material assets start out with a historical cost and then this value is depreciated according to a predetermined scheme. The scheme is determined at the time of acquisition. Only hard evidence will make it possible to deviate from this scheme. Recently there has been a trend to substitute the historical valuation of assets with a fair market valuation in which the current market value of the asset is used in the accounting valuation of the asset.

The presentation of this problem follows Christensen and Frimor (2007). Inherently the value of a firm is uncertain. To keep the presentation simple suppose that the uncertainty consists of two

components one summarizes the internal factors of the firm and the second summarizes the external factors to the firm.

$$V = \varepsilon_A + \varepsilon_E \tag{6}$$

It is assumed that the firm observes the first error term and only observes the second error term with error. Thus the firm and its auditor observes

$$y_A = \varepsilon_A, y_F = \varepsilon_E + \varepsilon_{AU} \tag{7}$$

The firm and its accountant are confined to a single report stating the expected value of the firm conditional on the information which is allowed by the recognition rules. There are two possibilities for the recognition rules and that will lead to two reporting options. One is a historical cost model in which the recognition rule only allows the internal factors of the firm into the accounting valuation V_H. The alternative set of recognition rules allows the accountant to aggregate the observed external factors into the reported value of the firm. This set of recognition rules brings market observations into the accounting valuation and in this sense it has the flavor of fair value accounting. The accountant uses all the information he has got to derive accounting value and this is his expectation of market value, V_F. In both cases the accountant is disclosing an unbiased report subject to his information constraint. The report published by the firm under the two regimes can be calculated assuming that all information variables are normally distributed with zero means.

$$V_H = E(V \mid y_A) = y_A$$

$$V_F = E(V \mid y_A, y_E) = y_A + \frac{\sigma_E^2}{\sigma_E^2 + \sigma_{AU}^2} y_E$$

The investors observe the accounting report prior to trading. They also observe the external factors of the firm with yet another error term. Each investor makes his own private observation, and the error term for each investor is personal but follows the same distribution. To simplify it is assumed that all the error terms of the investors are uncorrelated. In addition the investors observe the price, P, at which the stock of the firm is traded. Thus the investor observes

$$y_{E,i} = \varepsilon_E + \varepsilon_i, P, V_i$$

The security is traded in the open market and the price is formed when the investors meet and decide on their individual trading. There is uncertainty in the market as all individual endowments are stochastic and assumed normal with variance σ_z^2. This leaves the model tractable and prevents the prices from being too informative. The investors only disclose their private information through the pricing mechanism and there is no direct information exchange among the investors. Supposedly the investors participate in an anonymous trading mechanism transforming the individual bids and form a price. The investors are rational and when entering into the pricing game they anticipate the reaction of their co-traders. The market clearing price is reflects this conjecture and consequently it is assumed that the resulting price is a rational expectations equilibrium. The model used for this analysis stems from Hellweg (1980).

The equilibrium price for this mechanism reflects the market uncertainty, σ_z^2, the private information of the investors and the information content in the accounting report.

The important question is how to evaluate the two accounting options. One method is to analyze how the accounting valuation is aligned to the market valuation. The relevant measure for this is the squared difference between the accounting valuation and the market value. This is often used in empirical research as both measures are readily available, cf. Schipper and Vincent (2003). This measure would clearly favor the market based accounting valuation as the accounting valuation includes the second error term.

An evaluation of the accounting system is closely linked to the ability of the accounting system to provide useful information for decision making. The difference between the accounting value and the market value is not necessarily a proxy for that. The final outcome of the decisions is what matters to the investor.

The market value might be a good proxy for the final outcome. At the same time the market value works as an information aggregator, aggregating all the information available to the investors including the private information and the accounting information. This role is not highlighted when only the difference between the accounting value and market value is evaluated. This is a partial view of the relative performance of the two accounting systems. Consequently this is not necessarily a good measure of the merits of the accounting system. Furthermore, this leads to that another measure of the merits of the two accounting options would be the squared difference between the price of the asset and the final pay out from the investment. This is a measure of the

aggregate informativeness of the accounting system. This is not easy to measure empirically as the final dividend only materializes with considerable time lag for most investments. In the present setting it is possible to evaluate this measure analytically. The measure reflects the ability of price to reflect the information which is available to the market participants. It is of no relevance to the measure how the information is transferred to the price. Consequently it provides a measure of who is best at aggregating the information the accountant or the market.

It is not easy to get an analytical solution to the described problem showing exactly which accounting system is optimal and also it depends on the specific parameter values. It is possible to calculate the value of the valuation error as a variance, Var(.). The valuation error is calculated for the two accounting systems as a function of the ability of the accountant to estimate the "market" information, i.e. as a function of the variance σ_{AU}^2. If the auditor is very good at estimating the market factor ε_E the variance σ_{AU}^2 is very small. Only the fair value accounting system depends on this quality as the accountant's measure of fair value enters the accounting valuation. The transaction based accounting system is independent of the ability of the accountant to measure the market component.

In figure 1 the performances of the two accounting systems are calculated when the market uncertainty is large. That is when the variance of the initial wealth of the investors is large. In that case it is expected that the market price will carry little information from the individual investors and consequently it is expected that even less able accounting systems will be able to provide useful market information to the price mechanism. The graph for the fair value accounting system shows a smaller variance even for relative large σ_{AU}^2.

Insert figure 1 here

The calculations are repeated for smaller market uncertainty in figure 2. In that case it is expected that the market price will reflect the investors' private information to a large extent and consequently there is primarily a demand for the accounting information to supplement the information that is already available in the market. Consequently it is expected that the transaction based accounting system will outperform the fair value accounting system. Analyzing the graphs

presented in figure 2 reveals that it is indeed the case. The two graph intersect at $\sigma_{AU}^2 = 0.02$ implying that the accountant should outperform the average investor 50 times when it comes to estimating the market influence on the performance of the firm.

Insert figure 2 here

Concluding remarks

The common theme of this paper has been the errors of accounting system. Errors are important and often neglected when the design of accounting systems is evaluated. Accounting carries information as often recognized but the full impact of that statement is not endogenized in the analysis as suggested by Demski (2004).

First the information perspective call for using the accounting information to update our expectation of the future events of the firm, cost, cash flows etc. The important element of this is what we learn from the accounting statement and what we knew before. The quality of both pieces of information is important for consistent updating of beliefs as suggested by Bayes theorem. When the world is normal distributed the quality is measured by variances. The use of quality includes this but is broadened to a more general setting. The notion of information quality in this sense is almost missing from the accounting literature as for example the variance of accounting measure are not discussed in accounting texts as Horngren et al (2009). The focus point of getting information is the error terms and in particular the autocorrelation of error terms. Only when there is dependency across time we learn something useful from studying the accounts. Then the time series properties are important for extracting the information.

The accounting system provides information about the firm as it is providing a picture of the financial position of the firm. The accounting mapping is a linear construction. The accounting system uses a linear aggregation of transactions in the accumulation accounts, in allocation of cost and benefits to cost objects and in the presentation in the balance sheet. Yet the world is hardly linear. Economics of scale and scope is found everywhere and is often the reason for the existence and size of firms. The consequence of the assumed linearity is structural errors. There are many reasons to stick to the linearity assumption as estimating the "correct" functional form of some

accounts is an impossible task. The result is that the errors persist and the system designer can counter this through the allocation mechanisms employed. This calls for attention to allocation of errors of the accounting system. For some products accurate cost estimates are essential and costing errors are better allocated elsewhere.

Finally the accounting system is not the only information system in the world. Other and perhaps more timely information sources exist. The accounting system must acknowledge this fact and act accordingly. The comparative advantage of the accounting system must be considered and some tasks are better left for other information sources. The debate on fair value accounting provides an example of this. The accounting system has a non disputed advantage in reporting on firm specific information. Aggregating market information into this might or might not be a good idea. The basic question here is who is best at performing the aggregation of the market information. The market mechanism is a powerful information aggregator and it might be better suited for aggregating the firm specific and the market information. When this is done through the accounting system the cost is that the market error term is aggregated with the firm specific error term. This way the investors must use their private information about the market error to disentangle the firm specific and the market information. The alternative in the transaction based accounting system is to provide the investors firm specific information directly and let the market interaction perform the aggregation. This way the accountants' observation of the market information is lost or not used.

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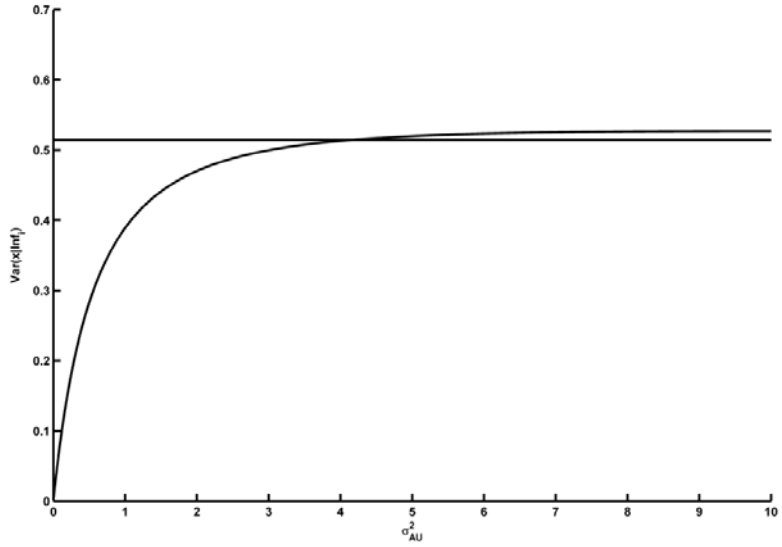
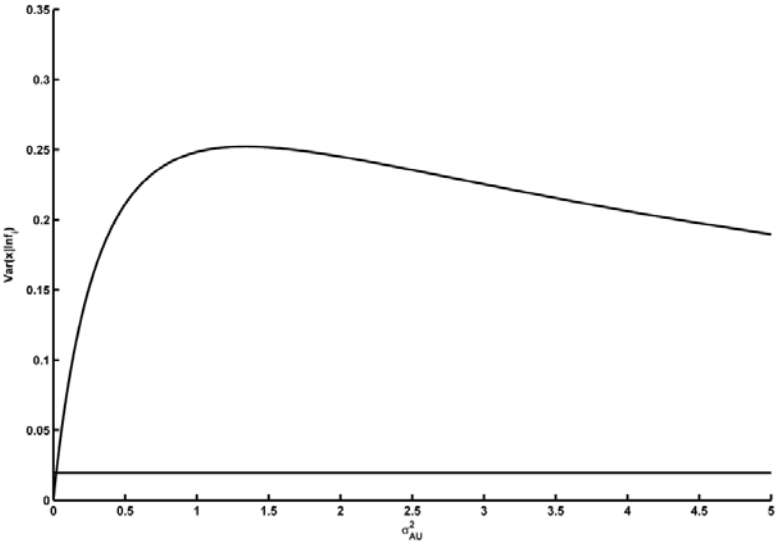


Figur 1: High market uncertainty



Figur 2: Low market uncertainty