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Measurement of Assets and the Classical Measurement Theory

ABSTRACT

The classical measurement theory was dominant in science until the late 1940s. Then it was challenged by the modern measurement theory, which began to be adopted in accounting in the 1960s. The adoption was superficial though. The terminological shift from valuation to measurement seems to have been the only significant change. Quite recently, however, the IASB has silently started to take steps in the direction of the classical measurement theory. The most important sign of this is the emphasis given to making observations, which are essential in the classical theory. For example, the recent standard IFRS 13 Fair Value Measurement exhibits a strong emphasis on observable market phenomena. This increased attention to observation has provided the main motivation for this paper: to see what accounting could gain from the classical measurement theory. The aim of this paper is to elaborate on the key concepts of the classical measurement theory, to explain the implications of the classical measurement theory for the concept of an asset, and to propose a new measurement-based classification of assets. The classification is based on the distinctions between instrumental and economic value, between basic resource and non-basic resource, between measurement and allocation, and between measurement and forecasting. The ultimate purpose of these distinctions is to reach a classification of assets that might help in making fruitful empirical risk assessments.

Keywords: *Allocation, economic reality, measurement, prediction, property, quantification*

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1. INTRODUCTION

Measurement has been practised for thousands of years but its closer analysis is relatively recent (Abdel-Magid, 1979, p. 346). Conceptually measurement, or mensuration as it is sometimes called in the physical sciences, has been regarded as the application of numbers to reality. According to Menger (1959, p. 97), as far as physical objects are concerned, the oldest approach to the subject is the theory of Helmholtz (1887). His influential ideas were followed by Campbell (1920, 1928 and 1953), who is the originator of what is now called fundamental and derived measurement and the developer of classical measurement theory.

According to classical theory, measurement is restricted to assigning numbers to represent properties on the basis of physical laws discovered through the fundamental or derived measurement processes (Campbell, 1953, pp. 109–39). The fundamental measurement of a property requires a physical operation of addition to be found that turns out to be similar to the mathematical operation of addition (Cohen and Nagel, 1934, pp. 296–7). For example, the proposition that 2 + 2 = 4 can be demonstrated purely arithmetically without any experiment, but proper experiments are required to further demonstrate that the suggested physical operation of addition does indeed conform to the familiar properties of pure arithmetical addition. Derived measurements are then measured by an indirect process in which measurements are obtained on the basis of numerical laws relating fundamental measurements (Campbell, 1953, pp. 124–39; Cohen and Nagel, 1934, pp. 298–301).

Restricting measurement to fundamental and derived measurement makes the concept of measurement narrow and the possibilities to apply it relatively limited. Yet this restrictive view, based mainly on the needs of the physical sciences, dominated until it was challenged by the social scientist S. S. Stevens, who defined measurement in broad terms as 'the assignment of numerals to objects or events according to rules' (Stevens, 1946, p. 677). Later he made the definition even broader claiming that literally no restrictions are needed and measurement could be defined as 'the assignment of numerals to objects or events according to rule – any rule' (Stevens, 1959, p. 19).

This extremely broad view of measurement was later labelled as the modern measurement theory (Abdel-Magid, 1979, p. 348), and it was welcomed with enthusiasm for various reasons, some of which, however, were rather questionable. For example, Bunge (1973, p. 121) remarks critically that 'the theories of "measurement" discussed in the methodology of behavioural science … have become a pastime of mathematicians and philosophers precisely because they make only modest demands on substantive knowledge'. Accountants, too, applauded with cheers the freedom of labelling literally any process of assigning numbers to objects as measurement. This is apparent shows from the comments of the distinguished committee of the American Accounting

Association (AAA) (Ijiri et al., 1971, p. 46): 'Those who hold a restrictive view of measurement may feel uneasy about speaking of forecasts as measurement, speaking of numbers derived from arbitrary allocations as measurement, and speaking of nominal measures such as telephone numbers as measurement.'

This great enthusiasm was also reflected in Bierman's (1963, p. 501) declaration: 'Accounting is the art of measuring and communicating financial information. This statement is not shocking or even surprising, yet the acknowledgment that accounting is concerned with measurement is a first necessary step towards a long awaited revolution in accounting. … It is time for restrictive definitions of measurement in accounting to topple.' However, that these remarks might eventually turn out to be overstatements was anticipated by Larson (1969, p. 38): 'But if measurement comes to mean no more than traditional accounting methodology, the revolution may never ensue.' The authors never elaborated the concept of revolution, but it may still be fair to say that Larson's anticipation has been more or less correct, at least if it was the predictive value (as defined, for example, in Hendriksen and van Breda, 1992, p. 134) of accounting information that they were referring to.

But if it was the predictive value of accounting information that Bierman and others were hoping to improve, why did they give such a minor role to the theory of measurement? This question is relevant because it seems that the only role given to the modern measurement theory was to provide accounting with some new terminology. It seems that no substantive insight was seriously looked for, that is, insight that would change accounting methodology. This seems to have been the case until quite recently. Perhaps the only recent publication trying to elaborate on the substantive potential of measurement theory in financial accounting is the book chapter by Vehmanen (2007, pp. 152–72), where the key concepts of measurement theory are discussed and related to accounting valuation. The focus is on fair values and their measurement-theoretic characteristics, which leads to classifying assets into three categories: actual measurements, potential measurements, and forecasts. This paper builds on the same premises but takes the classification further. To give some background to this view and motivation for the paper, a few key points of the history of measurement are now recounted.

The classical measurement theory was dominant in science until it was challenged by the modern measurement theory in the late 1940s. Neither was applied in accounting until the 1960s. That is when accounting adopted the modern theory, but the adoption was superficial. The terminological shift from valuation to measurement seems to have been the only significant change. Defining measurement as the assignment of numerals to objects or events according to rule did not require any substantive changes, for example, changes in the rules of depreciation. Quite recently, however, the IASB has started to take steps in the direction of the classical measurement theory. The most important sign of this is the emphasis that the IASB has started to give to the concept of observation. There are references to observation, for example, in the concept of direct verification in the *Conceptual Framework* (IASB, 2010, p. 21) and more importantly in the recent standard IFRS 13 *Fair Value Measurement* (IASB, 2012, see, e.g., paragraphs 2, 3, 61 and 67). These recent steps are the major motivation for this paper. It is worthwhile investigating whether accounting could gain more than just the terminology from classical measurement theory.

It is a challenge here that there are quite a few definitions of measurement (and views of measurement theory) in the literature. Fortunately, however, what really matters is whether the definition (and corresponding theory) may be classified as broad or narrow. Any definition of measurement that puts the emphasis on rules without making requirements regarding observation is here classified as broad. The above-quoted definition by Stevens is more or less directly the origin of all these definitions. On the other hand, only definitions of measurement that explicitly refer to observation and require it are here classified as narrow. For example, Bunge's (1967, p. 194) notion that 'quantitative observation is measurement' falls into this category. Consequently, if a definition cannot be classified as narrow it must simply be classified as broad. Moreover, any measurement theory that rests upon the narrow view of measurement is here labelled as classical. Similarly, the measurement theory that rests upon the broad view of measurement is here labelled as modern.

The aim of this paper is to elaborate on the key concepts of the classical measurement theory, to explain the implications of this theory for the concept of an asset, and finally to propose a new measurement-based classification of assets for financial reporting. The specific research questions of the paper are: (1) what are the implications of classical measurement theory to the meaning and valuation of assets in financial reporting, and (2) how might the implications of classical measurement theory be usefully applied to categorizing assets for financial reporting? As explained in section 6, the main contributions of the paper lie in providing a sound theoretical framework for the recent trend in the promulgations of the IASB to emphasize the role of observation, and in suggesting a theoretically supported reclassification of assets for financial reporting that may prove to be useful in the risk assessment of firms.

The paper is limited to studying measurement of assets because assets are often regarded as the most fundamental element of financial statements. For example, the IASB *Conceptual Framework* actually defines all the other four elements of financial statements as functions of assets (IASB, 2010, pp. 25–32). Liabilities are present obligations to give up assets, equities are residual interests in the assets, income is increases in net assets (other than those relating to contributions from equity participants) and expenses are decreases in net assets (other than those relating to distributions to equity participants). The new measurement-based classification of assets may come close to the liquidity-based classification which is allowed by IAS 1 (para. 60) if the resulting information is reliable and more relevant than information based on current/non-current distinctions. The relevance is evident if it can be shown that the new measurement-based classification results in information that helps in making predictions regarding future profits or dividends, or if it can be shown to improve forecast models regarding distressed firms. Moreover, the distribution of assets among these new classes of assets may turn out to be relevant in assessing the riskiness of the firm.

2. REVIEW OF THE LITERATURE

Helmholtz (1887) and Campbell (1920 and 1928) dominated the measurement scene until the 1940s. Stevens (1946) was the first to challenge their view of fundamental and derived measurement. He was later joined by several behavioural scientists including Weitzenhoffer (1951), Coombs (1952), and Torgerson (1958), all of whom supported the broad use of measurement. Today the broad view is common practice in accounting, too, and admittedly there is nothing intrinsically wrong with the broad usage of measurement (Brodbeck, 1968a, p. 575). A concept may be defined in any way one wishes as long as one makes the definition explicit (Sterling, 1970, p. 69). This may, however, cause difficulties in interpersonal communications. Difficulties may also arise when one gives seemingly acceptable reasons for the chosen definition which, on closer examination, turn out to be false. This is what happened when the above-mentioned committee of the American Accounting Association tried to present positive arguments in support of its own decision to choose the broad definition of measurement.

The committee stated (Ijiri *et al.*, 1971, p. 46): 'To support a broader view on measurement, let us quote from several sources. One of the most comprehensive modern works of epistemology gives us the following:' The comprehensive source is Bunge (1967, p. 194), and the citation is as follows: 'Quantitative observation is measurement. Whenever numbers are assigned to certain traits on the basis of observation, measurements are being taken.'

The citation, however, does not support the argumentation of the committee for the following reasons. First, the broad view does not require observation to be quantitative (see, e.g., Brodbeck, 1968a, pp. 574–5). It allows it equally well to be qualitative. Second, by definition the broad view accepts any rule, and hence it does not necessarily require observation. Third, by definition the broad view assigns numerals, not numbers. Numerals are only symbols standing for numbers. Therefore, the broad view is in sharp contrast to the approach that accepts restrictions on the concept of measurement. More specifically, the restricted approach assigns *numbers* to *quantities* on the basis of *observation*.

The broad view is ambiguous with respect to the rules it allows. It allows any rule. It is also ambiguous with respect to specifying the object of measurement. As Peter Caws (1959, p. 3) has remarked: ‘Measurement presupposes something to be measured, and, unless we know what that something is, no measurement can have any significance.’ Accounting has this very problem, and obviously Larson (1969, p. 39) was aware of it when he pondered over forty years ago: ‘What are those “things” accountants measure? A cursory answer may involve listing several items such as assets, equities, revenue, expense, and income. Yet the voluminous literature on the nature of these items suggests that they are, at best, only hazy notions of the “things” accountants measure. … It is no overstatement to say that the precise nature of the “things” measured in accounting has not been determined.’ The broad view of measurement has been of no help in specifying what the object of measurement might be. This topic will be reconsidered later with the concept of property.

The classical and modern views of measurement theory are methodological alternatives. Besides these methodological alternatives, there are also philosophical alternatives. They require that the choice should be made between the ontological assumptions about whether or not the “reality” to be investigated by researchers is external to the individual (Burrell and Morgan, 1979, pp. 1–2). The two extreme philosophical views are typically labelled “realism” and “social constructivism”. The choice between them has been disputed as severely as the choice between the narrow and the broad view of measurement. For example, Mouck (2004, p. 527) describes the arena of these disputes as follows: ‘There is obviously a huge chasm between the realism of mainstream practitioners and researchers on the one hand and the social constructivism of critical accounting researchers on the other. … The mainstream literature, including the FASB’s official publications, tends to focus on “measurement problems”, suggesting that accountants are dealing with independently existing economic and financial phenomena.’ The critical-interpretive accounting literature, on the other hand, inclines toward the view that all reality is socially constructed, or in Mattessich’s (1995, p. 275) words, ‘accountants do not represent reality but create it’.

The latter view has important implications. One of these is that accountants should ‘abandon any kind of science’ (Mattessich, 1995, p. 275). Another is that accountants should also abandon the correspondence theory of truth because it presupposes external reality. It defines truth as a correspondence between a statement and the facts of the underlying reality (Kerlinger, 1964, p. 431; Shapiro, 1997, p. 167; Shapiro, 1998, p. 654).

Accounting scholars including Hines (1988 and 1991) as well as Macintosh and Shearer (2000) have offered extreme interpretations of social constructivism. For example, Hines (1988, p. 252) argues: ‘We recognize revenue when it is realized: that’s what we say – “we recognize revenue and gains when they are realized”. We create the impression that they do not exist, and that suddenly, they become real, and we recognize them as such. But of course, we make them real, by recognizing them as real.’

There are more moderate interpretations of social constructivism too. For example, Heath (1987, p. 2) states: 'Income is a conceptual model. … It cannot be observed or measured directly. It is determined by measuring one of the attributes of a company's assets and liabilities (that is, their cost or value), then manipulating those data in accordance with a set of rules. … Although the accounting concept of income is *a model of real-world events* [emphasis added], income does not exist in the real world any more than a family with 1.6 children exists in the real world. Both exist only in our minds.'

In Heath's view part of the world is socially constructed while the rest of it exists independently of the observer. The same idea is introduced in Mattessich's "onion model of reality" (Mattessich, 2003, pp. 446–9), which apparently is, in turn, based on the widely cited analysis of the well-known American philosopher John Searle (1995, pp. 27–9). He distinguishes explicitly between *brute facts*, which exist independently of any human institutions, and *institutional facts*, which can only exist within human institutions and are thus socially constructed. The word "realism" has been used in a wide variety of meanings. However, as an ontological theory it simply states that there exists a reality totally independent of our representations (Searle, 1995, pp. 153–5). That is all it says. For example, realism does not say anything about how the external world is.

Although this implies that we cannot say anything specific about the brute facts of reality, it also implies that there is something in reality besides socially constructed institutional facts, and we may want to represent them for communicative purposes. Some of these representations could be considered more "realistic" than others. For example, Schuetze (2001, pp. 12–15) seems to be calling for an extremely naïve interpretation of realism in saying: 'The FASB's definition of an asset is so complex, so abstract, so open-ended, so all-inclusive and so vague that we cannot use it to solve problems. … Defining an asset as a probable future economic benefit is to use a high-order abstraction. … I think that we should account for *real things* [emphasis added] such as trucks, not abstract future economic benefits.'

What does all this mean? Do the disputes between the philosophical issues of realism and social constructivism mean that one must take a stand upon them before going on to discuss the subtleties of measurement? Fortunately not. Although it is true that practices in accounting clearly presuppose certain beliefs, it is, however, not at all clear that accounting, or any other social practice, presupposes any philosophical beliefs. McKernan (2007, p. 173) refers to Rorty and argues convincingly that philosophical beliefs are not really relevant to accounting practice because they are just not tied very closely either to observation or to practice. Therefore, changes in those philosophical beliefs will generally not give us good reason to change our practices. Hence, it is not considered important in this paper to take any stands upon different versions of realism and social constructivism.

3. BASIC CONCEPTS OF ACCOUNTING MEASUREMENT

3.1 Definition

In scientific inquiry definitions are sometimes considered to have a relatively minor role and sometimes a more complex role. Ackoff (1962, pp. 141–2), for example, only gives two categories of definitions: 'There are two types of defining in science: conceptual and operational. Conceptual defining is sometime called constitutive … or contextual …. This type of definition relates the concept being defined to one or more other concepts and generally takes a form similar to that of dictionary definitions. Operational definitions, on the other hand, relate a concept to what would be observed if certain operations are performed under specified conditions on specified objects.'

In general the purpose of definitions is to clarify the meaning of concepts (Hempel, 1952, pp. 6–14). Defining uses other concepts. As Ackoff (1962, p. 175) says: 'All definitions use other concepts and hence presuppose their meaning. In general we try to use simpler concepts than the one being defined. But simplicity is a relative concept, not absolute. There are no concepts that are absolutely simple and whose meaning is fixed and known.'

This means that the role of defining may be more complex than it appears above. For example, Hanson (1969, p. 26) points out: 'A definition is a setting out of the meaning of a symbol or cluster of symbols. It may be more than that. It may be less. But this is a good beginning. For it becomes immediately clear that there must be as many kinds of definition as there are ways of setting out meanings.' Hanson continues that in an ideal science every concept would have a sharp edge – a boundary (although, as he says, it is difficult to imagine what such an ideal science would be like). Definition is a preliminary step in the search for logical boundaries. Measurement is another step that marks boundaries still more clearly (Hanson, 1969, p. 42).

The final statement above raises the question about the relationship between definition and measurement. This is pointed out by Caws (1959, p. 3): 'Definition and measurement certainly have functional similarities which make it almost inevitable that a discussion of one should sooner or later involve the other.' It is interesting to note that Caws (1959, p. 5) comes close to saying that these two processes are the same: 'Definition requires the replacement of one symbol in an expression by another symbol or symbols; measurement requires the replacement of a symbol by a number, itself also a symbol. It is not far from this point to an identification of the two processes.' This ultimate conclusion will not, however, be drawn in this paper. Instead, definition will be distinguished from measurement and rather considered to be a close relative of what is later called quantification.

Defining gives the meaning of a concept but it does not specify the degree to which the specific property is present. For example, one may know the meaning of concepts such as length or wealth and yet be unable to specify how long or wealthy the thing or person is. That is the purpose of measurement: to give information in quantitative terms. And when quantitative information becomes available one not only knows the meaning of the object or event but is also able to make comparisons between them (Sterling, 1979, pp. 74–5).

3.2 Measurement, Quantification, Property and Observation

The deliberations by Caws and Hanson imply that measurement is a concept with no sharp boundaries. This is also implied by Wartofsky (1968, p. 153). He explains how measurement has its roots in the process of identification, comparison and classification. One is not only interested in the meaning of a concept but also in comparing some aspects of objects. What these aspects are, Wartofsky (1968, p. 154) formulates as follows: 'At the very foundations of any process of measurement is the humblest and most modest of intellectual and linguistic operations: that of identifying something as of a given kind. … In observation, we already classify, in that preliminary way which the observation language exhibits, predicating this of that. What we single out, then, are features of things, which in various contexts or by different conventions we call *properties* or *attributes* or *qualities*.' What they are should be specified, but as Kerlinger (1964, p. 431) notes, this is not typically done: 'We say we measure objects, but this is not quite true. We measure the properties or the characteristics, of these objects.'

Accounting is a good example of a discipline where the property to be measured is typically not well explicated. For example, Staubus (1986, p. 117) states: 'The accounting measurement process focuses on wealth and its derivative, income. … The methods accountants use in measuring assets and liabilities are the subject of much accounting literature. … To measure a wealth item means to assign a number to its size – to place a value on the item.' The same ambiguity is obvious in the Discussion Paper *Measurement Bases for Financial Accounting – Initial Recognition* as it talks loosely about "measuring assets" and "measurement of assets" (AcSB, 2005, paras. 24, 30, 31, 75 and 179).

The narrow view of measurement requires, however, that one first identifies a property and then determines how much of it is present on the basis of observation. But what do we mean by observation? Bunge (1967, p. 162) gives a clear answer: 'Observation proper can be characterized as *purposeful* and *enlightened* perception: purposeful or deliberate because it is made with a given definite aim; enlightened because it is somehow guided by a body of knowledge.' Observations are not all alike however. Some are direct and some are indirect. Direct observation requires the object to be perceptible, while indirect observation is in fact a hypothetical inference involving both observational data and hypotheses. That is the case, for example, when one is "observing" a person's feelings (Bunge 1967, p. 162).

Observation varies in other respects as well. For example, according to Bunge (1967, p. 194), to be precise, observation must be quantitative. Hence Bunge sees quantification as the link between observation and measurement. He even says that quantitative observation is measurement and continues saying that there are as many kinds of measurement as kinds of properties and measurement techniques. Consequently, to understand the features of measurement one must first analyse the nature of quantification.

The conceptual operation of introducing quantitative concepts is called quantification or, more precisely, numerical quantification (Bunge, 1973, pp. 105–6). Numerical quantification refers to any procedure whereby certain concepts are associated with numerical variables (Bunge, 1967, p. 194). When an individual value of y (where y is a generic number) is assigned to a certain property of a definite object with the help of observation, the empirical operation called measurement is performed (Bunge, 1967, p. 206). Numerical quantification is to introduce a functional correspondence between the degrees of some assumed property and numbers (Bunge, 1973, p. 108). Its purpose is to make empirical measurement possible, but as an operation it is not empirical itself. Instead it is a conceptual operation like defining based on theoretical knowledge and imagination. The goal is to invent a new quantitative concept that maintains, however, the substance of the meaning of the original qualitative concept. In other words, the goal is to add precision to the qualitative concept without losing anything essential of its meaning.

For example, the expression 'income is increases in net assets other than those relating to contributions from equity participants' is a qualitative definition. It gives the meaning of "income" but does not specify how much of it is present over a given period of time. That requires numerical quantification of assets. A theoretically sound way of doing it might be: "let us quantify an asset in terms of its exit value". That may be accepted if exit values are found to be observable. If they are, one can proceed to empirical measurement, if they are not, the attempt to quantify income has failed and measurements cannot be made. In order to make them one would have to invent some other way to quantify assets.

For measurement to convey meaningful information from observable properties the functional correspondence resulting from the numerical quantification must be effective. To satisfy that requirement, the correspondence must be designed such that the measurement procedure and the number system become *isomorphic* to reality, where isomorphism means identity or similarity of form (Kerlinger, 1964, p. 430). In Brodbeck's (1968b, p. 580) words: 'The technical term for the similarity between a thing and a model of it is *isomorphism*. Isomorphism requires two conditions. First, there must be one-to-one correspondence between the elements of the model and the elements of the thing of which it is the model. … Second, certain relations are preserved.' When there is a functional correspondence (that is, mapping) but it is less complete, the measurement procedure and the number system become under certain conditions *homomorphic* to reality. Mock (1976, p. 13) formulates this as follows: 'If the mapping is one-to-one and the relationships are preserved it is isomorphic. A many-to-one mapping which preserves relations is homomorphic.'

Quantitative properties are called quantities or magnitudes. Magnitudes are properties that admit of being ordered in terms of degrees or amounts (Wartofsky, 1968, p. 160). Magnitudes that are additive with respect to the object variable are called *extensive* properties, and magnitudes that are non-additive with respect to the object variable are called *intensive* properties (see, e.g., Brodbeck, 1968a, pp. 575–6; Bunge, 1967, p. 200; Hanson, 1969, p. 51; Wartofsky, 1968, p. 160). In the 1960s and '70s it was actively discussed whether an extensive accounting property satisfying the useful feature of being additive could be found (see, e.g., Chambers, 1967; Larson, 1967; Larson and Schattke, 1966; Lim, 1966; Mattessich, 1964, pp. 79–80; McKeown, 1972; Mock, 1976, pp. 21–3, 46; Trowell, 1980; and Vickrey, 1970, 1975, 1976). The result was that additivity only holds in some restricted conditions because assets typically interact and thus create positive or negative synergy effects. But how many of these effects are created did not stimulate any discussion. This continues to be a relevant research issue, however, because synergy effects presumably have a significant role in forecasting the value in use of assets and liabilities taken either separately or combined in some way.

As for the object of measurement, there is one additional clarification that should be made, and it should be made no matter whether the object is labelled as a property or an attribute or a quality. Kaplan (1968, p. 602) elaborates it as follows: 'The point is that both quality and quantity are misconceived when they are taken to be antithetical or even alternative. Quantities are *of* qualities, and a measured quality *has* just the magnitude expressed in its measure. In a less metaphysical idiom, we could say that whether something is identified as a quality or as a quantity depends on how we choose to represent it in our symbolism.' In accounting this means, for example, that it is the quality of exit value of an item that observable market prices, when available, express in quantitative terms.

To summarize, following Bunge (1967, p. 206 and 1973, p. 120), the definition of measurement that is consistent with the classical measurement theory may now be formulated as follows: *Measurement* is the effective assignment of numbers to numerically quantified properties of the object or event using the empirical operation of observation.

3.3 Forecasting, Prediction and Allocation

After having defined measurement as an empirical operation requiring observation, it is easy to agree with the remark by Ijiri et al. (1971, p. 46): 'Those who hold a restrictive view of measurement may feel uneasy about speaking of forecasts as measurement, speaking of numbers derived from arbitrary allocations as measurement, and speaking of nominal measures such as telephone numbers as measurement.' And it is more than just feeling uneasy. For example, regarding forecasts as measurements blurs the whole concept.

Forecasting is to say in advance what is likely to happen in the future (Hornby *et al*., 1966, p. 389). For example, to say that we are likely to have some rain tomorrow is a forecast rather than a measurement because the truth of that statement cannot be currently resolved by observation. For the same reason the statement claiming that the economic life of a given machine is five years should be classified as a forecast. However, in spite of the relevant time horizon being longer in the latter statement than in the former one, this does not necessarily have to be the case. The reason is that some statements saying in advance what is likely to happen in the future should be labelled as predictions rather than forecasts.

Prediction is thus an alternative conceptual way of saying something about what is likely to happen in the future. More precisely, *prediction* is defined as the act of stating in advance that something will happen (Hornby et al., 1966, p. 760). Therefore, the distinguishing feature between forecasts and predictions is not the length of the relevant time period but the level of certainty involved. A forecast anticipates that something "is likely to happen" while a prediction states that something "will happen". For example, weather forecasts are generally considered so uncertain that it is appropriate to talk about forecasts rather than predictions even though it will only take a day or two to verify the truth of the statement. On the other hand, the statement concerning the economic life of a machine may be supported by such an amount of evidence that it is appropriate to talk about predicting rather than forecasting even though the relevant time period is years rather than days.

If it is the level of certainty rather than the length of the relevant time period that distinguishes predictions from forecasts, how can certainty be increased to the level that justifies the terminological shift from forecasting to prediction? The answer lies in the process of accumulating evidence, that is, by making sufficient observations and inferences based on these observations. Therefore, ultimately it is the kind and quantity of observation that makes the difference between measurement, forecasting and prediction.

Measurement is definitely an operation that requires observation. More precisely, using Bunge's (1967, p. 162) terminology, measurement is an operation that requires direct observation, that is, the object of measurement must be perceptible. Ellis (1966, p. 54) labels this kind of measurement as *actual* measurement, which refers to such a process where the necessary quantitative observations are actually made. Actual measurement has another name too: it is sometimes called measurement by empirical fact.

Prediction is also an operation that requires observation, but what distinguishes prediction from measurement is that in the case of prediction it suffices that observation is indirect rather than direct. In other words, prediction is an operation that requires both observational data and hypotheses. Eventually when a sufficient amount of observational data has been accumulated and the relevant hypothesis has been reasonably well tested, one may establish an empirical law. Based on this law rather than the previously tentative hypothesis, predictions have increased credibility, and hence they may be called measurements by (scientific or empirical) law or *potential* measurements (Ellis, 1966, p. 54). These measurements are potential rather than actual, because they are based on indirect observation thus being conditional on the correctness of the underlying hypothesis. Moreover, if the relevant time period is sufficiently short, the accuracy of the potential measurement may be resolved by actually conducting the experiment or observing the outcome in controlled conditions. In the case of forecasting, however, there is no such experiment, and the only way to determine the correctness of the forecast is to wait and see.

The point is that after having established an empirical law (scientifically supported or just backed up by solid experience), the outcome of the event or experiment may be predicted on the basis of the law without actually waiting for the event to take place or conducting the experiment. For example, as Sterling (1979, p. 71) explains, it is not necessary to expend the potential heat energy of a coal reserve by actually burning the reserve to say how much potential energy the reserve contains. Instead the amount may be predicted (that is, potentially measured) with the help of the previously discovered empirical law. Similarly, it is not necessary to actually sell a used car in the second-hand market to make a prediction (that is, a potential measurement) about the amount of money that could be received if the car were in fact sold. The only practical difference in these examples is related to the amount of observational evidence there is to support the underlying law. Scarce evidence provides feeble laws and greater errors in measurements, but as Bunge (1967, p. 209) argues, to some extent there are errors in all measurement.

Therefore, even if the boundaries between measurement, forecasting and prediction are not sharp, these concepts are here considered distinct enough for the purpose of classifying assets later on. There is one plausible, but not acceptable, reason that may explain why so many accountants are willing to regard forecasts as measurements. If one adopts the previously discussed ontology of social constructivism and considers reality socially constructed, then one may be tempted to think that the forecast related to the future is in the mind of the person in the present thus becoming part of the current economic reality. But it is the expectation that is current and thus part of the economic reality, not the facts that have been forecast.

Allocation differs fundamentally from measurement, forecasting and prediction in the sense that it is purely discretionary and almost totally independent from observation. Allocation is defined as the process of partitioning a set or amount and the assignment of the resulting subsets to separate classifications or periods of time (Hendriksen, 1977, p. 205). Allocation is discretionary because no limits are set to the process of partitioning, and allocation is nearly independent from observation because only the set or amount to be partitioned is linked to observation but not the outcome. Therefore, allocations can never be confirmed or refuted by empirical observation.

Typical accounting allocations are assigned portions of a joint total to factors that are presumably related to this total (Ijiri, 1975, pp. 183–6). Depreciation is a good example of an accounting allocation. The purchase price of an asset is the joint total that is considered to be related to the economic life of the asset. The purchase price is then partitioned into subsets according to some discretionary rule, and the economic life of the asset is expressed in a number of equal periods. Finally the subsets are assigned to the given periods. The point is that nothing other than discretion guides these assignments. That is why allocations can neither be supported nor refuted by empirical evidence, and this applies to the choice of the depreciation method as well. Therefore the choice of the depreciation method is completely discretionary, which made Thomas (1969, 1974) conclude that the choice is *arbitrary*.

To sum up, forecasting and allocation should be excluded from measurement, because they lack a firm link to observation. Prediction, however, may be included in measurement, because predictions are observable in principle although they are not typically results of current observation (that is, direct observation). Instead they are based on prior observation and inferences based on this observation (that is, indirect observation), which has allowed a more or less convincingly supported law to be established.

3.4 Value, Valuation and Valuation Techniques

Value is an old concept both in accounting and economics. As pointed out by Vehmanen (2007, pp. 161–2), Adam Smith defined value in 1776 in two different ways. First, value may express the utility of some particular object, and second, value may express the power of an object to purchase other goods. In the first case he used the term "value in use", while in the second case the corresponding term was "value in exchange" (Chambers, 2002, p. 126). Later on, almost a hundred years ago, the Dutchman Theodore Limperg (1879–1961) applied the same idea but used different terminology (Burgert, 1972, pp. 111–13). He replaced the term "value in use" with the phrase "indirect realizable value" and the term "value in exchange" with the phrase "direct realizable value".

Value being such an old concept, it is surprising that the more recent theoretical accounting literature does not typically define valuation (see, e.g., Abdel-Khalik, 1998, p. 308; Belkaoui, 2000, pp. 483, 515; Deegan, 2001, p. 441; Evans, 2003, p. 365; Hendriksen and van Breda, 1992, pp. 465–6, 905; Horngren and Harrison, 1989, p. 386; Horngren et al., 1994, p. 968; Sterling, 1979, pp. 117–57). The definition cannot be found in the more practical accounting literature either. For example, valuation is not defined in the IASB *Conceptual Framework* (IASB, 2012, pp. A21–A51) or in the Discussion Paper *Measurement Bases for Financial Accounting – Measurement on Initial Recognition* (AcSB, 2005).

What is even more surprising is that until the 1960s the term "valuation" was extensively used in accounting, and after that it practically disappeared. What could have been the reason for this? It is likely that the answer is in the adoption of the term "measurement", that is, the term "valuation" was gradually replaced by the term "measurement". The terminological shift was observed, for example, by Griffin et al. (1971, p. 3) as they stated: '"Valuation" is generally used in accounting in reference to the process of applying specifiable methods which result in the assignment of numbers to represent economic properties. Thus perceived, the term valuation is essentially synonymous with the term measurement.'

To make valuation and measurement synonymous may also have been the intention of the above-mentioned committee of the American Accounting Association when it gave the following definition (Ijiri et al., 1971, pp. 46–47): 'accounting measurement is an assignment of numerals to an entity's past, present, or future economic phenomena, on the basis of past or present observation and according to rules. ... the rules employed need not be good ones and observations made need not be correct to qualify as accounting measurement.' This definition is broad in spite of its reference to observation because it refers to assigning numerals even to an entity's future economic phenomena. Such assignments are forecasts (unless they are based on established laws, which would make them predictions and hence potential measurements). Moreover, what made the committee's broad view of measurement even broader than accounting valuation was their decision to extend measurements to "arbitrary measurements" (ibid. p. 46). Presumably "arbitrary valuations" have never been discussed in the accounting literature. Perhaps, however, making that extension was unintentional, and therefore it is concluded here that what was called "valuation" in the 1960s and before started to be called "measurement" in the 1960s and thereafter.

Hence the shift in terminology from "valuation" to "measurement" started in the 1960s, but it only seems to have occurred in the English language and not in other languages. That is at least what the following examples indicate. In English, IAS 16 *Property, Plant and Equipment* has the following title for paragraphs 15–28 (Official Journal of the European Union, http://eur-lex.europa.eu): "Measurement at recognition". In German the corresponding title is: "Bewertung bei erstmaligem Ansatz", and in French the same title is: "Évaluation lors de la comptabilisation". Further, in Spanish the title is: "Valoración en el momento del reconocimiento". Let us also take two Scandinavian languages. In Swedish the title is: "Värdering vid första redovisningstillfället", and in Finnish it is: "Arvostaminen kirjaamisen tapahtuessa". It is surprising that none of these other languages uses the term "measurement". Instead they use a term that translates to "valuation".

In English, however, the term "measurement" has become more and more common in contexts where it used to be commonplace to talk about "valuation". For example, Mattessich (2003, p. 460) states: 'But what is in dispute is the valuation (i.e. the measurement or estimate) of this income …'. On the other hand, Staubus (1986, p. 117) remarks: 'To measure a wealth item means to assign a number to its size – to place a value on the item.' Moreover, Sterling (1970, p. 247) uses the word "valuation" as he states: 'It is said that the valuation basis used in the accounting tradition is "historical cost" […]'. A close counterpart for this statement can be found thirty-five years later using the term "measurement": 'The alternative measurement bases identified from a search of the accounting literature are: historical cost, current cost [...]' (AcSB, 2005, p. 7).

To summarize, it seems that academic and practically oriented texts in English regard valuation and measurement as synonymous. The view of measurement is then the modern view. This paper, however, is exploring the potential of the classical view, which leads to the suggestion that valuation and measurement should not be considered synonymous but as two distinct concepts having their own specific meanings. Measurement is restricted to the effective assignment of numbers to numerically quantified properties of the object or event using the empirical operation of observation, while valuation may retain the traditional meaning cited above, that is, valuation may be defined as the process of applying specifiable methods that result in the assignment of numbers to represent economic properties (Griffin *et al.*, 1971, p. 3).

Value is here interpreted to have two different meanings. On the one hand, it is the qualitative property that is being assessed, for example an economic property. On the other hand, it is the numerical outcome of the valuation process. These outcomes are obtained by valuation techniques. Valuation techniques are extensively used and classified, for example in IFRS 13 *Fair Value Measurement*, but there is no definition for them in the standard. Here a *valuation technique* is defined as the systematic apparatus by means of which the realization of a value is assessed (cf. Rescher, 1969, pp. 65–6).

As qualitative properties, values may be classified in various ways. One way is to classify them according to their origins. From the economic perspective the origins lie in market phenomena which are characterized by sacrifices made and benefits gained. Hence a *dualistic* concept of value may be applied as Ijiri (1975, pp. 64–5) suggests. Values are then either input values (sacrifices) or output values (benefits). Input values may be actual (historical costs) or potential (current costs, that is, reproduction costs or replacement costs). Output values, too, may be actual (realized sales prices) or potential. In the latter case they may be direct (realizable values) or indirect (values in use).

In the dualistic approach actual and potential values differ significantly from one another. Actual input and output values are directly observable. They are realized prices, and their quantities may be measured in the classical sense by observing actual market exchanges. The resulting measurements have many desirable characteristics. For example, they are additive (Sterling, 1979, pp. 162–74), and they do not involve subjective discretion. The same cannot be said of potential input and output values. Some of them are not even indirectly observable, and they depend on factors requiring discretion. For example, potential output prices are different in different markets and at different times (AcSB, 2005, paras. 74–82; Sterling, 1979, p. 73). Moreover, the level of aggregation or categorization of products may make a big difference. That is, a product may be sold as a whole for one price and in parts for prices that do not add up to the price of the whole (AcSB, 2005, paras. 71–3; Sterling, 1979, pp. 171–3).

Consequently only some potential values are measurements in the classical sense which requires that the underlying phenomena must be observable, directly or indirectly. Therefore it must be possible to predict, not just to forecast, the actual outcome of the potential value. For example, the direct realizable value of a product is typically predictable and satisfies this requirement. However, the value in use of a machine is an indirect value that requires forecasting. Such forecasting takes a long time, during which actual production and selling take place, and the conversion of the value in use into actual observable money is typically not based on any established empirical law.

Another way to classify values is by the methodological role they have in economic conditions. This leads to *three* kinds of values: intrinsic, instrumental and economic values. Intrinsic values lie at the heart of ethics. Philosophers claim that the intrinsic value of something is the value that the thing has "in itself", "for its own sake", "as such" or "in its own right". All other values are extrinsic (http://plato.stanford.edu). Consequently, extrinsic values are either instrumental or economic. The difference between intrinsic values and instrumental values is explained by Wartofsky (1968, p. 120) using money as an example: 'For basic coin is valued simply by the convention that permits one to exchange other things for it. It has no character other than the methodological, and one cannot make claims for its intrinsic value, but only for its instrumental value. What establishes this value for it is the whole system that underwrites the exchange – the monetary system and the public agreement that upholds it.'

Instrumental value provides a means to bring content into economic values. More specifically, economic (benefit) value is an extrinsic value that may be quantified in terms of the instrumental value. That is the kind of value that, for example, the IASB *Conceptual Framework* (2012, p. A40) refers to when it defines an asset in terms of "future economic benefits". It is obvious, therefore, that with the help of instrumental value, economic benefit values play the central role in financial accounting, while intrinsic values have no real role in it. Intrinsic values fall totally outside financial accounting, which only deals with extrinsic values. It takes one resource (cash and cash equivalents) to which it attaches instrumental value and expresses the economic (benefit) value of all other resources in terms of this instrumental value.

To sum up, valuation is here seen in its traditional sense as the process of applying specifiable methods which result in the assignment of numbers to represent economic properties. Valuation may use various valuation techniques which refer to the systematic apparatuses by means of which the realization of values is assessed. The apparatuses may vary. Measurement in its classical sense is one apparatus for valuation. It may be actual or potential. Forecasting is another apparatus. It may be based on a more or less scientific model or simply on judgment. Allocation is yet another apparatus. It may be purely arbitrary or it may try to estimate an outcome, thus being a form of forecasting. These concepts provide a means to reclassify assets, which is the ultimate aim of this paper. Before the reclassification, however, the concept of an asset is discussed in more detail because the mainstream definitions of it can be interpreted in a circular fashion and are thus unable to provide a sound basis for a definition that is applicable in the context of the classical measurement theory.

4. THE CONCEPT OF AN ASSET AND MEASURABLE PROPERTY

The IASB *Conceptual Framework* (para. 4.4 (a)) defines an asset as follows: 'An asset is a resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity' (IASB, 2012, p. A40). The puzzling characteristic of this definition is its idea of making all assets depend on future economic benefits, which in turn are defined in terms of the potential to contribute to the flow of cash and cash equivalents. This idea leads to circularity when one tries to argue why cash and cash equivalents are assets. They are assets because they have the potential to generate more cash and cash equivalents (Vehmanen, 2007, pp. 153–6). Notably the quoted current definition of an asset in the IASB *Conceptual Framework* bears no relation at all to observation. Therefore, from the perspective of the classical measurement theory, it requires some modification.

The joint IASB/FASB conceptual framework project team does not acknowledge this. It continues its work along traditional lines, although it has gradually been revising its working definition. The first two revisions were only marginal (IASB, 2005 and IASB, 2006a) leaving the circularity problem unresolved. In July 2006 the definition of an asset was again revised. The IASB (2006b, p. 4) rephrased it as follows: 'An asset is a present economic resource to which an entity has a present right or other privileged access. An asset of an entity has three essential characteristics: (a) there is an economic resource; (b) the entity has rights or other privileged access to the economic resource; (c) the economic resource and the rights or other privileged access both exist at the financial statement date.'

This definition does not eliminate the circularity problem either. According to the IASB Update (2006b, p. 4), the Board asked the staff to give further consideration to some aspects of the definition and amplifying text, including the following: 'Clarify that an economic resource exists when there is a non-zero probability of generating inbound cash flows or reducing outbound cash flows.' This indicates that the circularity problem has only been relegated one step, and is now in the definition of a resource. That becomes evident in justifying why cash and cash equivalents are economic resources. They qualify as economic resources if 'there is a non-zero probability of generating inbound cash flows or reducing outbound cash flows'. This requirement is likely to be satisfied in a well-functioning economy and thus cash and cash equivalents would qualify as economic resources. They would further qualify as assets because (1) the corresponding economic resource exists, and (2) there is a non-zero probability that this economic resource is capable of generating a positive net cash inflow.

To show one way to resolve the circularity problem, let us first recall that all definitions are hierarchical using other concepts and presupposing their meaning (Ackoff, 1962, p. 175). At the top level an asset may be defined following the IASB Update (2006b, p. 4): 'An asset is a present economic resource to which an entity has a present right or other privileged access.' Assets are thus restricted to resources that embody economic benefits. To prevent the second-level concept of resource from becoming circular, the next step is essential: one has to postulate that the economic benefits embodied in a resource may be *actual* or *potential*.

The actual economic benefit of the given resource refers to its measurable quantity expressing in units how much of it is present. For example, the actual economic benefit of cash in hand is the amount of the cash in some currency units. Similarly, the actual economic benefit of oil in store is the amount of the oil, say, in litres or gallons. Since the units for measuring quantities may vary from one resource to another, it is obvious that if we want to have a reporting system where all the resources are expressed in a common unit, we have to select one resource to serve as the "basic resource". That is the only resource for which the actual economic benefit will be measured in its own units. The amount of actual economic benefit in a unit is identical to the amount of its instrumental value, thus providing the system with a means to express the potential economic benefit of any given resource. If the unit is assumed to be constant over time, then it will not only provide a means to represent other resources but will also provide a means to retain (or store) economic benefit. Hence the basic resource has a unique role, which in a modern economy is typically given to cash and cash equivalents. Thus cash and cash equivalents are chosen to be the resource that stores economic benefits and at the same time serves as a means to express potential economic benefits.

As explained by Vehmanen (2007, p. 164), the potential economic benefit of any given resource refers to the capability of that resource to contribute, directly or indirectly, to the flow of the basic resource to the entity. Having selected cash and cash equivalents to serve as the basic resource, the potential economic benefit of any given resource refers to the capability of that resource to contribute, directly or indirectly, to the flow of cash and cash equivalents to the entity. For example, under these assumptions a machine does not embody any actual economic benefit simply because its quantity is not measured directly in currency units. Instead it may carry potential economic benefit. This is true if and only if it has the capability to contribute, directly or indirectly, to the flow of cash and cash equivalents to the entity.

A non-basic resource is any class of resources having utility in terms of potential economic benefits (Vehmanen, 2007, p. 164). A non-basic resource thus has the capability to contribute, directly or indirectly, to the flow of the basic resource (cash and cash equivalents) to the entity. If an item does not have that capability, it is not a resource. For example, if an asset (being a resource) loses its capability to contribute to the flow of cash and cash equivalents to the entity, it ceases to be an asset and must be derecognized (cf. IAS 16, para. 67).

The circularity problem in the definitions of the IASB stems from the idea of making the value of all assets depend on the future. Nothing, including cash, is considered to have value now. And if nothing has value now, then there is no current quantity that could serve as a standard for value. Even quantitative units of cash, say euro and dollar, would refer to future amounts of money and could not serve as current standards. This is comparable to an attempt to measure distances without first setting an observable standard, for example, a metre or a yard (Vehmanen, 2007, p. 154). For precisely the same reason that one needs a standard for measuring distances, one also needs a current standard for measuring values. The unit of measurement for the basic resource provides this standard assuming that its quantity can be currently observed. The instrumental value of the unit equals its actual economic value. It also equals the potential economic value of the unit, because any currency unit of cash and cash equivalent is assumed to be exchangeable with an identical currency unit. On the other hand, the potential economic value of any non-basic resource is given in terms of the instrumental value it is capable of generating, directly or indirectly, to the entity.

It is obvious that the basic resource has a crucial role in valuation. Moreover, it also has a role in defining the *property* to be reported, for example, historical cost or fair value, because the property should be expressed in terms of the basic resource (cash and cash equivalents). But what does not follow from this is that there should only be one property, or that the property should be such that it allows itself to be measured in the classical sense. The financial markets will determine which properties are in demand and which ones are not. Similarly, the markets will determine whether they prefer classical measurements to forecasts and allocations or whether they want both at the same time. Therefore, this paper does not try to identify a single property to be reported. Instead what is presented in the final section of the paper is a classification of typical accounting valuations that shows how accounting measurements and some other kinds of currently used valuation techniques are related to one another.

5. RECLASSIFICATION OF ASSETS

Provided that one resource, say cash and cash equivalents, is selected to serve as the basic resource, there is no measurement-theoretical obstacle to defining an asset as the IASB does in its

Conceptual Framework (para. 4.4 (a)). Then in financial reports an asset has a value that is the result of the selected valuation technique. Valuation techniques vary. There are as many valuation techniques as there are ways to assign a value to an object. For financial reporting these techniques are here divided into two groups: measurement-based and forecast-based (see Figure 1). The former are valuation techniques that are based on classical measurement while the latter are valuation techniques that apply forecasting in one way or another. They are "forecast laden" in the same sense as facts that are more or less dependent on theoretical knowledge are sometimes called "theory laden" (Goldstein and Goldstein, 1978, p. 18).

When can a value be classified as measurement based? Classical measurement requires more than just an "identification of the measurement basis" (AcSB, 2005, p. 7). One must also invent and apply an empirical instrument or procedure. That is, "identification of the measurement basis" is insufficient here because the basis alone does not ensure classical measurement. For example, if historical cost is identified as the "measurement basis" and a method of depreciation is subsequently applied to the given historical cost, then there are two totally different stages involved. At the recognition stage, measurement is performed in both the modern and classical sense, because the actual purchase transaction has typically been observed. At the stages after recognition, the situation is different though. Depreciation is only measurement in the modern sense. If one takes the classical view, then depreciation is merely a conceptual operation, not an empirical operation of measurement. To clarify further, consider the old example of weighing how heavy something is. There the required empirical instrument for measurement is the beam balance, which is an invention that makes possible the empirical observation of weights.

Since "identification of the measurement basis" is not sufficient and an instrument for empirical observation is also needed, one must resolve what that instrument might be. Just as cash and cash equivalents were the most appealing choice for the basic resource, the market mechanism is the most appealing choice for the instrument of measurement in the case of values (Vehmanen, 2007, pp. 165–6). Note that this is also the stand of the IASB in IFRS 13 *Fair Value Measurement*. The standard considers fair values to be market-based measurements and emphasizes observable market transactions as the prime source of fair values (para. 2). Further, when market prices for identical assets are not available and other valuation techniques must be used, the entity must try to maximize the use of relevant observable inputs to those techniques (para. 3). Similarly, well-functioning (active) markets are here regarded as the instrument that provides financial accounting with actual and potential measurements for the balance sheet. This means that one can classify a value as being measurement based if and only if it can be supported by direct or indirect observations from active markets. Direct observation results in actual and indirect observation in potential measurements.

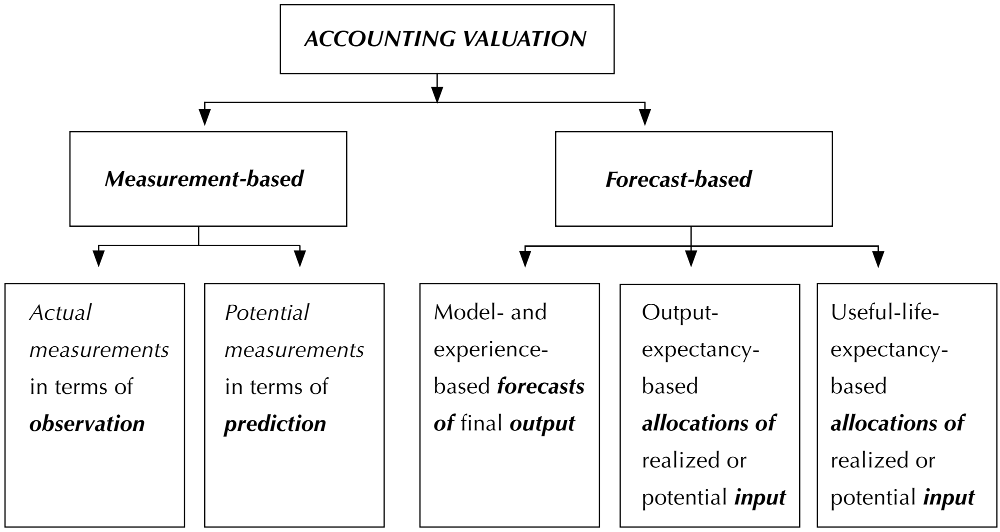

Figure 1. ***Valuation, classical measurement and the proposed classification of assets***

It is likely, however, that classical measurements do not suffice for the financial markets. Traditionally they also require forecast-based information of assets that may be classified in various ways. One way to do this is in terms of the role that the output plays in the valuation of an asset. The output may have been forecast in cash and cash equivalents (that is, in currency units) and reported as an asset, or the output may have been forecast in non-currency units (for example, cubic metres) to facilitate the matching of inputs to outputs, or the final output may only have been forecast in terms of useful life (for example, months or years) to facilitate the discretionary allocation of the input. This means that, besides the two measurement-based categories of assets, there would be three forecast-based categories (see Figure 1). These five categories represent five different groups of valuation techniques and five different groups of assets. A brief discussion of each category will bring this paper to its conclusion.

5.1 Actual measurements in terms of observation

The first valuation technique results in assets for which the selected property can be measured directly by quantitative observation. The selected property is the quantity of the instrumental value that is present in the asset, that is, the quantity of cash and cash equivalents that the asset possesses. The only asset for which this property can be directly observed is the basic resource itself (cash and cash equivalents). Consequently, the first category of assets only consists of cash and cash equivalents. For these assets their quantity is equal to their value (cf. Ijiri, 1975, p. 75). The selected property is extensive, satisfying the requirement of additivity, which implies that no matter how one combines cash and cash equivalents, the value of the resulting total may be correctly predicted using the arithmetical operation of addition.

Moreover, for cash and cash equivalents, their actual input value is equal to their potential output value, that is, cash in hand may be exchanged for an equivalent amount of cash in an arm's-length transaction. From this it follows that all actual measurements of cash and cash equivalents are numbers that represent their fair value (as defined in IFRS 13 *Fair Value Measurement*, para. 9). The level of certainty in these measurements is very high, and therefore the error of measurement is typically negligible.

5.2 Potential measurements in terms of prediction

The second valuation technique results in assets for which the above-mentioned property can only be measured indirectly, that is, only by prediction, not by direct quantitative observation. These assets have potential economic benefit value. They contribute, directly or indirectly, to the flow of cash and cash equivalents, which in turn has instrumental value for the entity. Consequently, this category contains the assets that are observable in principle with respect to the selected property. That is, for these assets the amounts of cash and cash equivalents that they possess (or represent) are not actually observed but they may be predicted on the basis of past experience and more or less convincing empirical laws.

Depending on the length of the time horizon in the prediction, the phrase "observable in principle" may have somewhat different meanings. If the time horizon is relatively short, "observable in principle" may refer to the possibility of actually collecting, if so desired, the predicted amount of cash and cash equivalents. For example, the exit value of a used car is "observable in principle" in this strong sense. However, if the time horizon is relatively long, thus precluding current observations, "observable in principle" refers to the previous direct observations on which the empirical law is based and which can also be repeated over time but not currently. For example, the exit value of a financial instrument with long maturity and currently non-active markets may be "observable in principle" in this weaker sense.

Potential measurements are thus measurements in the classical sense because either their quantitative accuracy may be confirmed by current empirical observation or their quantitative accuracy has already been confirmed by a sufficiently large amount of previous empirical observation. Moreover, potential measurements are fair values because the confirmation of their quantitative accuracy would be resolved in an arm's-length transaction. The level of certainty regarding these measurements would normally be lower than that of actual measurements. From the typical requirements of recognition, however, it follows that one expects that these amounts "can be measured with reliability" (IASB, 2010, paragraph 4.38). Receivables, financial investments and categories of inventories are examples of assets for which the predictability requirement of potential measurement may be satisfied.

Hence fair values (as defined in IFRS 13 *Fair Value Measurement*, para. 9) of the above-mentioned assets may be potential measurements and fall into this second category. That will be the case, however, if and only if they satisfy the requirement of being observable. This requirement is evidently satisfied if there are quoted market prices available for identical assets. It may also be satisfied if valuation techniques are used and the relevant inputs to those techniques are all observable. Depending on whether the inputs used in the valuation techniques are observable or not, IFRS 13 (paras. 72–90) classifies fair values into three categories: (1) unadjusted quoted prices in active markets for identical items, (2) other observable inputs than the Level 1 quoted prices, and (3) unobservable inputs. Consequently, because inputs within the third level are unobservable, fair values in the third category do not qualify as potential measurements based on prediction.

There may be an error of measurement involved in determining fair values. It depends on how perfectly the market is functioning and how much evidence has been accumulated about the market behaviour. When the evidence is substantial, empirical laws may be postulated and built into the valuation techniques. Fair values may then be predicted using these valuation techniques.

5.3 Model- and experience-based forecasts of final output

The third valuation technique results in assets that have been valued by their long-term potential to contribute, directly or indirectly, to the flow of cash and cash equivalents to the entity. The amounts of cash and cash equivalents have not been predicted however. They have been forecast, which means that the numbers in this category are not measurements but forecast values, that is, forecast amounts of cash and cash equivalents. The correctness of these amounts can neither be currently determined nor supported by established empirical laws. It will always take time to ascertain whether the forecast amounts were actually correct or not. Therefore, these amounts are not observable, although empirical phenomena will eventually reveal the accuracy of these forecast values. Assets valued using the present-value technique fall into this third category.

This category is recognized by the IASB *Conceptual Framework* (para. 4.55 (d)) which gives the present value as one possible “measurement basis”: ‘Assets are carried at the present discounted value of the future net cash inflows that the item is expected to generate in the normal course of business.’ Present values are not measurements, however, but forecasts, which is also observed by the AcSB (2005, para. 51) in stating: ‘*Present value* is not a measurement basis, but is rather a technique that can be applied to estimate a number of the above measurements in certain circumstances.’ The statement is quite surprising, because it implies that the AcSB has the classical, not modern, view of measurement.

The same analysis applies to the value-in-use concept as to the present-value concept. Values in use are not measurements in the classical sense. Therefore, any item on the balance sheet that is based on either one of these concepts should be reported in this third category, that is, as forecasts of final output.

For example, IAS 36 states that if an asset of the entity is impaired an impairment loss must be recognized (para. 1). An asset is impaired when its carrying amount exceeds its recoverable amount (para. 8). The recoverable amount of an asset is the higher of its fair value less costs to sell and its value in use, where the value in use is the present value of the future cash flows expected to be derived from the asset (para. 6). This valuation rule involves both potential measurement and forecasting. Fair values and costs would typically be based on publicly observable prices, which would make them potential measurements. However, fair values may also be based on valuation techniques using significant unobservable inputs (IFRS 13, para. 86), and they would then have to be classified as forecasts. Moreover, values in use are never measurements in the classical sense but forecasts. Consequently, any value on the balance sheet that is determined using the test for impairment is a forecast unless the recoverable amount is considered to equal the fair value of the asset less costs to sell and the fair value is based on observable inputs and on a reasonably well-established valuation technique. This should be reflected in the choice of reporting category.

5.4 Output-expectancy-based allocations of realized or potential input

The fourth valuation technique results in a value that is equal to the unexpired cost of the asset (Belkaoui, 2000, p. 170). It is obtained by depreciation accounting based on the forecast output either in terms of units produced or revenue earned. The output is matched either to the actual input value (that is, historical cost or acquisition cost) or to the potential input value (that is, current cost, which typically means reproduction cost or replacement cost). Whether actual or potential input prices are used, the resulting values are at the same time forecasts and allocations. They are forecasts because the output must be forecast, and they are allocations because the actual or potential input value must be allocated to the forecast output. But they are never measurements in the classical sense because they cannot be observed, and therefore they should be reported distinctly.

The distinct nature of this category derives from the concept of depreciation (Hendriksen and van Breda, 1992, pp. 523–35). If depreciation is simply defined as a systematic and rational method of allocating particular costs (original or restated costs less scrap value), then there would be no need for this fourth category. Instead, the category below (the fifth category) could be used. If, however, depreciation is defined as the process of allocating the cost or other basis of the services rendered by the item to the products or periods that used those services, then it is informative to consider the fourth category distinctly. It represents assets that are valued on the basis of forecast decline in service potential.

Depletion accounting, defined as the rational, systematic allocation of the cost of an unextracted natural resource to the extracted units of the natural resource (Kreiser, 1998, pp. 128–9), is an example of an accounting method that falls into this fourth category. It involves both forecasting (which is typically called "estimation" in this context) of the total units of recoverable natural resources and allocation of the cost of these resources to the cost the extracted units. Depletion expense, defined as the portion of the natural resources that is used up in a particular period (Horngren and Harrison, 1989, p. 401), represents the decline in the service potential of these resources typically classified as plant assets.

Service-potential-based depreciation has one advantage over simple rational and systematic allocation. It recognizes that the loss in service potential may be irregular and also provides a means to report it. It requires, however, that the decline in service potential must be forecast using some surrogate measure. The number of units that will be produced and the number of hours that the asset is expected to be in operation are examples of surrogates expressing the output in physical terms. Similarly, the amount of revenue is an example of a surrogate expressing the output in monetary terms.

5.5 Useful-life-expectancy-based allocations of realized or potential input

The fifth valuation technique, too, results in asset values that are equal to the unexpired cost of the assets. The only difference to the fourth category is that in this technique one does not try to forecast the actual output of the asset but only its useful life in years. After this has been done, one must simply allocate the depreciation basis over the useful life of the asset according to some rational and systematic method. The depreciation basis consists of particular costs in precisely the same way as in the fourth category. The resulting asset values are again both forecasts and allocations but never measurements in the classical sense.

Accounting for intangible assets is an example of an accounting method that falls into this fifth category. The acquisition cost of an intangible asset is expensed through amortization, which applies to intangible assets in the same way depreciation applies to plant assets and depletion applies to natural resources (Horngren and Harrison, 1989, p. 401). Amortization is typically computed on a straight-line basis over the asset's forecast (or "estimated") useful life thus involving both forecasting and allocation.

Notice, however, that although the resulting asset values in the fourth and fifth categories are not themselves classical measurements, they are based on such measurements. At initial recognition the original historical cost, that is, the purchase price, is an actual observation-based measurement of the exchange value of the asset. After initial recognition, however, as soon as one starts manipulating the initial value in depreciation accounting, the resulting values become forecasts and allocations. The same is true of restated costs such as current costs. At initial recognition both reproduction cost and replacement cost are potential measurements of the exchange value of the asset. They, too, become forecasts and allocations as soon as they become part of depreciation accounting.

6. CONTRIBUTION OF THE PAPER

The contribution of this paper is discussed with respect to the following sources: two publications of the IASB, Sterling (1979), Ijiri (1975), and Vehmanen (2007). The IASB has increased its emphasis on observation without explicitly acknowledging it. The Conceptual Framework (IASB, 2010, para. 4.54, p. 37) continues to define measurement as 'the process of determining the monetary amounts at which the elements of the financial statements are to be recognised and carried in the balance sheet and income statement'. This definition has been taken as such from the 1989 version of the Conceptual Framework (IASB, 2010, p. 25). The distinctive feature of the definition is that measurement has no links to observation. The same is true about indirect verification. The Conceptual Framework (IASB, 2010, para. QC.27, p. 21) defines indirect verification as 'checking the inputs to a model, formula or other technique and recalculating the outputs using the same methodology'. This definition bears no relationship to observation either. Yet, in the recent promulgation IFRS 13 Fair Value Measurement observation plays a significant role. As the Conceptual Framework only has a minor role for observation this notably strong emphasis appears to come from nowhere. The ability to give a sound theoretical framework to this emphasis in terms of classical measurement theory is the first contribution of this paper.

This paper builds in many respects on the book by Sterling (1979), for example in agreeing that measurement should be distinguished from both forecasting and allocation, and also in acknowledging that forecasting and prediction should be kept apart. What is different here, however, is the basis for the distinction. Sterling (1979, p. 79) argues that a proposed law 'would pass the predictive ability test in the scientific sense' if the 'prediction is capable of verification'. For example, exit values as defined by Sterling (1979, p. 70) are capable of verification because it is in principle possible to sell the item in question and thus verify whether the hypothesis concerning its sales price is true or not. This, however, means that Sterling considers the time horizon in predictions to be so short that a more or less immediate sale is possible. In this paper, however, it is not the length of the time period in the prediction that is the determining factor but the credibility of the law used in the prediction. This paper takes the concepts of direct and indirect observation from Bunge (1967, p. 162) to distinguish measurements (actual measurements), predictions (potential measurements) and forecasts (not directly or indirectly observable). The elaboration of the differences between these three concepts is the second contribution of this paper.

Unlike the publications of the IASB, this paper distinguishes between the basic and non-basic resources. The idea for this innovative distinction came from the book by Ijiri (1975). In other respects, however, the ideas of that book are not followed here. More specifically, Ijiri puts amazingly little emphasis on observation, for example, as he says: '... the mode of exchange is well defined [in historical cost accounting] by the exchange transaction itself and the historical cost of a whole is by definition equal to the sum of the historical costs of its parts'. In other words, Ijiri claims that the additivity problem does not exist in historical cost accounting because the historical costs of the inputs can be arithmetically added together. Here, however, the view is that the issue of additivity is always linked to the output propositions of the theoretical setting and therefore it is an issue of empirical verification based on observation. The identification of the important role of the basic resource in the *Conceptual Framework* is the third contribution of this paper.

Finally, this paper builds on the conceptual analysis and tentative classification of assets suggested by Vehmanen (2007). The two contributions with respect to that paper are the following. First, this paper develops more refined distinctions between the key concepts of measurement, prediction and forecasting. Moreover, this paper extends the three-category classification of assets (actual measurements, potential measurements and forecasts) into the five-category classification discussed above. The refined conceptual analysis and the extension of the classification are the fourth contribution of this paper.

7. CONCLUDING REMARKS

In the 1960s the concept of measurement was introduced to accounting with high hopes. Many even expected a revolution (Bierman, 1963, p. 501). Although the term revolution was never elaborated, it may have referred to the predictive value of information following the example of the natural sciences. In hindsight one may say that the revolution never ensued in any such sense. The main reason for this disappointment may have been that it was the modern view of measurement that was adopted, not the classical one. The modern view amounted to hardly more than a shift in terminology: the term "valuation" was replaced by the term "measurement".

The motivation for this paper came from the observation that the IASB has moved in the direction of the classical measurement theory, although not explicitly redefining measurement. IFRS 13 *Fair Value Measurement* is the most significant example of this because it puts such a great emphasis on making observations, which is precisely the emphasis that classical measurement theory makes too. In line with this the aim of the paper was to elaborate on the key concepts of the classical measurement theory, to explain the implications of this theory for the concept of an asset, and finally to propose a new measurement-based classification of assets for financial reporting.

Measurement was defined as the effective assignment of numbers to numerically quantified properties of the object or event using the empirical operation of observation. The main implication of this definition was that the value of assets cannot be measured unless the concept of an asset is modified. The current definitions make the value of all assets depend on the future, thus excluding the possibility of direct observation. This problem can be avoided either by introducing the basic resource as a unique asset having instrumental value or by reformulating the definition of an asset. For example, the definition in IASB Update (2006b, p. 4) could be reformulated as follows: 'An asset is a present economic resource [*embodying actual or potential economic benefits*] to which an entity has a present right or other privileged access.'

Assuming that one does not want to reduce the amount of information currently released in financial reports, they will continue to consist of information that is based only in part on classical measurement. The other part will be based on forecasting and allocation. The rationale for distinguishing measurements from forecasts and allocations is that forecasts are typically more uncertain and allocations are definitely more discretionary than measurements. Therefore the new five-category classification of assets may help in assessing the riskiness of various asset groups and the riskiness of the firm. Consequently it may also help in making risk/return assessments. Whether this really is the case or not requires further research in terms of empirical testing. ■

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