What is better: to be roughly right or exactly wrong?
The role of quantitative methods in financial accounting

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Abstract: The aim of this commentary is to discuss whether quantitative techniques are relevant for the development of financial accounting practice. We focus on the use of quantitative techniques in financial accounting practice rather than financial accounting research because since Ball and Brown (1968) and Beaver (1968), the association with academic research has already received considerable attention and produced a broad range of manuscripts. Our focal point is particularly within the rules of International Financial Reporting Standards (IFRSs), which allow or request the fair value measurement. Therefore, we aim to bridge this concept with quantitative techniques. We conclude that the use of quantitative methods in financial accounting is closely related to the development and use of fair value measurement in financial reports. Last but not least, some examples are given of how quantitative methods can improve the success of financial reports in the future.

Keywords: financial accounting; fair value; quantitative methods; accounting measurement; accounting informational relevance.

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1 Does financial accounting need quantitative techniques?

Financial accounting is a special logical system that captures certain business data, processes it into usable information which is communicated to decision makers. For this reason, it is called the language of business (Horngren et al., 1995). This system is also known as the accounting process or accounting cycle. Kieso and Weygandt (1986) mention that the accounting process begins with the choice of which transactions and economic events are eligible for the accounting bookkeeping and ends with the financial statements prepared.

The legitimacy of the financial accounting methodology can also be noted in the literature outside of accounting field. Weber (2010)\(^1\), for instance, points out that accounting conceived the preparation of a calculating rationality that offers to the productive economy a guidance, in a particular way, through market probabilities and to the consumptive economy, the establishment of an economic plan for the application of available resources. Weber (2006, p.26) also draws attention to the fact that “The modern rational organisation of capitalistic enterprise would not have been possible without two other important factors in its development: the separation of business from the household […] and closely connected with it, rational bookkeeping”.

However, one might wonder what is objectively the general purpose of financial accounting. The IASB (2009) states that financial reporting aims to supply information that supports allow funds allocation by capital providers, as well as to make an evaluation of corporate managers, the latter being known as stewardship.

Having these elements and definitions in mind; it is possible to conceive that financial accounting aims to provide information to forecast financial results, a matter that is extremely relevant for investors and creditors, which are generally interested in the prospects of cash flows to the firm they have allocated (or consider allocation), their own scarce resources under a certain level of risk; financial reports also allow the understanding of how efficiently and successfully the resources provided to a reporting entity were put in use by the entity’s management. Although financial statements are made of economic events that occurred in the past, part of these events are likely to affect the cash flows to and from the entity in the future. For this reason, there are two essential systems concerning timing in accounting, cash basis and accrual basis.

It is possible to understand both systems, cash and accrual, through the bottom line approach expressed in equation (1).

\[
Net\ Result_t = \sum_{i=1}^{n} Revenues_{t, i} - \sum_{j=1}^{n} Expenses_{t, j}
\]  

\(^{(1)}\)
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where the index $t$ is representing an actual period for revenues, expenses and, consequently, for the net result, which is the subtraction of both. The summation operator denotes that there are $n$th types of revenues indexed by $i$ and $n$th types of expenses indexed by $j$.

However, it is important to consider that equation (1) is just a synthetical simplification that does not specify for time differences arising from cash and accrual basis. As previously mentioned, financial accounting considers the both systems to record transactions. Therefore, equation (1) can be better-detailed through a timing split as showed in equation (2).

$$
\text{Net Result}_t = \left( \sum_{k=1}^{n} CSHR_{kt} + \sum_{l=1}^{n} ACCR_{lt} \right) - \left( \sum_{o=1}^{n} CSHE_{ot} + \sum_{p=1}^{n} ACCE_{pt} \right)
$$

(2)

where $CSHR$ represents cash revenues whereas $ACCR$ denotes accrual revenues, as well as $CSHE$ makes reference to the cash expenses while $ACCE$ is accrual expenses. Letters $k$, $l$, $o$ and $p$ are the indexes from the first to the $n$th element. The summation operators are used to denote that this process is a sum of discrete numbers.

Nevertheless, for those who study and research financial accounting, as well as for those who are practitioners of this field, is trivial to recognize that the transactions captured by the accrual basis are not homogeneous in terms of time and amount. As mentioned before, it is expected that all transactions recorded following the accrual basis will be (or have already been) converted into cash at some (different) point in time. The problem here consists in determining when this conversion will occur (or whether it has already occurred) and what is the value of its related cash flow. Therefore, items like accounts receivables and accounts payables have a more predictable financial performance than items like provisions, impairments losses allowances and other accounts with a more significant likelihood of forecast error. Scott (2003) states that the first group of accounts mentioned is deemed to be non-discretionary accruals due to their predictability features, i.e., timing and amounts are better known and subject to less forecast error, whereas the latter is known as discretionary-accruals.

Following this line of arguments, it would be reasonable to isolate accrual basis elements from equation (2) aiming to better understand its effects as expressed in equation (3) below.

$$
\text{Accrual Basis}_t = \left( \sum_{q=1}^{n} NDAR_{qt} + \sum_{r=1}^{n} DAR_{rt} \right) - \left( \sum_{s=1}^{n} NDAE_{st} + \sum_{u=1}^{n} DAE_{ut} \right)
$$

(3)

where $NDAR$ represents non-discretionary accruals related to revenues, $DAR$ denotes discretionary accruals associated with revenues, $NDAE$ signifies the non-discretionary accruals linked with expenses and $DAE$ connotes the discretionary accruals related to expenses.

Although one can further develop this model into increasingly analytical formulas, the split provided in equation (3) is enough to demonstrate that the terms $DAR$ and $DAE$ are expectations of future cash flow and that for their current recognition, estimates are
mandatory. This is where we claim that financial accounting needs the quantitative techniques.

The use of quantitative techniques in financial accounting allows the estimates of these elements (\textit{DAR} and \textit{DAE}) to be calculated with more robustness, rather than arbitrary judgement, reducing the likelihood of adverse results, (e.g., forecast error) and therefore increasing the prediction power of such figures. This mechanism provides more relevant accounting information to its users.

Quantitative methods are extensively used in modern financial accounting; some examples can be observed in financial instruments, biological assets, business combinations, investment properties, impairment tests, intangible assets, employee benefits, among others. Without a broad range of statistical tools, such as regression models, factorial analysis and logistic regressions, for instance, it would not be possible to carry out the measurement of these items as required in current accounting standards as IFRS.

However, the use of quantitative methods is also increasing due to the development of the fair value concept and its measurement. For this reason, this commentary about financial accounting and quantitative techniques benefits from examples coming from the IFRS because IFRS rules provide an extensive use of fair value measurement.

2 The ascent of fair value

According to the Ramana (2013) for the past two decades, fair value has been on the ascent and this marks a major departure from the old tradition of keeping books at historical costs. The author highlights that fair value accounting makes accounting information more relevant while historical cost is considered more conservative and reliable. Even though this is not a fresh discussion, Richard (2005, p.843) brings up that, “For more than two centuries two official systems of valuation existed side-by-side in the two large European countries which put the first state-regulated accounting system in place; the dynamic valuation system (based on cost value) and the static valuation system (based on market value)”.

It is relevant to mention that the fundamentals of fair value were formally pointed by Hicks (1939) in its brilliant discussion about capital and value, specifically when he considers that a producer can not define prices for its goods without market notion, furthermore, prices captures influences from expectations related to the future value of money; this is the main idea behind value.

Fama (1970) provides a very interesting complement to the idea that prices can in some instance capture the value, because prices are formed using all available information about companies signalling forecast financial results due to the past stewardship, which can be seen in the Fama’s introduction as reproduced below.

“The primary role of the capital market is allocation of ownership of the economy’s capital stock. In general terms, the ideal is a market in which prices provide accurate signals for resources allocation; that is, a market in which firms can make production-investment decisions and investors can choose among the securities that represent ownership of firms’ activities under the assumption that security prices at any time ‘fully reflect’ all available information. A market in which prices always ‘fully reflect’ available information is called ‘efficient.’” [FAMA, (1970), p.383]
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It is indispensable to note that Fama’s assertion regarding to the price idea as an informational approach that applies to the stock-market, which differs from other market structures due to its sui generis nature, which provides an environment of acting parties who do not know each other, parties that trade spontaneously and who essentially understand the transactions’ nuances. This concept closely relates to the Fair Value definition presented in IFRS 13 in its paragraph 9, “This IFRS defines fair value as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date”.

These features combined provide the conception of an exogenous scenario to the individual action and representative of the collective value consciousness with respect to shares listed in the capital market. Such indications are effectively considered in the decision-making of investors, since the observation of market prices, sometimes synonymous with fair value, is intuitively one of the main attributes of a capitalist economy, since decision making is supported by the possibility of measuring gains weighted by the respective risks.

It is important to note that although such characteristics may be similarly found in other trading organisations, (e.g., futures and some commodities), there are a large number of situations where typical conditions of an active market are not directly verifiable, or even exist, such as transactions involving intangible assets (trademarks and patents) or more complex circumstances involving transactions in unlisted firms.

In searching for evidence on the development of techniques that allow the verification of the fair value of items traded in non-active markets, we find an area of business studies that progress within an intersection among economics, finance, accounting and statistics, commonly denominated valuation.

Models employed in valuation analysis aim to pricing items by means of the development of market simulations. Among the most common tools is the concept of discounted cash flow (DCF), which purposes to construct a yield curve by means of indexers that represent the distinctive characteristics of the assets and bring them to present value by means of discounting the effect of extrinsic and intrinsic factors and therefore factoring into the valuation process the time value of money.

In this context, it is possible to segregate quantitative techniques at fair value into two groups divided by the nature of the items to be evaluated. On the one hand, items to be valued might have a homogeneous market in which prices are quoted actively. On the other hand, items being valued might be singular and traded in non-active markets or idiosyncratic markets. This bifurcation in the valuation of items gives rise to the expressions of ‘mark-to-market’ and mark-to-model, respectively and it is a fundamental feature to understand the coherence of the fair value reasoning. This feature also allows the development of a skeptical rationale about its validity, in essence as conceived in economic theory, fair value is the amount by which an item is traded in the marketplace; in the absence of such a market, one would have nothing but a fair value proxy.

In this sense, even in a conjectural argument, it is possible to deduce that attributions of gain or loss from the fair value derived from items quoted in active markets, due to their exogenous nature, are deemed to be more reliable than the measurements of elements traded in idiosyncratic or non-active markets. This is where we claim that quantitative methods gain relevance not only to allow the fair value measurement, but also to reduce the bias that is generally present in non-active markets or idiosyncratic transactions.
Using the same equation approach presented above, it is possible to see that the total fair value is a composition between items listed in active markets and those traded in non-active (or idiosyncratic) markets as expressed in equation (4).

\[
\text{Fair Value}_t = \sum_{t=1}^{n} IQAM_{t} + \sum_{t=1}^{n} IQNAM_{t} \tag{4}
\]

where \(IQAM\) represents items quoted in active markets and, furthermore, evaluated by mark-to-market techniques. \(IQNAM\) denotes items traded in non-active markets, for this reason, assessed by mark-to-model methods.

Considering equations (3) and (4), it is possible conjecture that the discretionary accruals are more expressive for \(IQNAM\) than \(IQAM\), because active markets provide time series information that are needed to compute the value of an item under Fama’s approach without, or less, individual judgment or intervention. This is the main argument of this subsection, the quantitative methods find an expressive relevance in financial accounting for items measured through fair value and non-quoted in active markets, because these techniques improve the fair value reliability.

### 3 Fair value accounting in IFRS perspective

The concept of fair value in the financial statements is preceded by high-level theoretical discussions related to a variety of pragmatic issues, such as the role of accounting reporting as a mechanism to reduce informational asymmetry, the destination of this information to specific groups of users and the relevance of the financial reports in activities of a prospective nature. In this sense, accounting, as an information system, evolves in a dynamic and interactive fashion, developing new methods of recognition, measurement and presentation of events that have quantitative and/or qualitative impacts in the wealth of organisations.

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Inputs values/entrance values</th>
<th>Outputs values/exit values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Past</td>
<td>Current</td>
</tr>
<tr>
<td>Approaches</td>
<td>Historical cost</td>
<td>Replacement cost</td>
</tr>
<tr>
<td>Techniques</td>
<td>Conservatism cost</td>
<td>Estimated value</td>
</tr>
<tr>
<td></td>
<td>Standard cost</td>
<td>Fair value</td>
</tr>
<tr>
<td></td>
<td>Original cost</td>
<td>Discounted cash flow</td>
</tr>
</tbody>
</table>

*Source: Hendriksen and Van Breda (1999)*

In this regard, Hendriksen and Van Breda (1999) point out that measurement is the process of assigning significant monetary values to objects or events associated with a company.

In addition, the authors clarify that there are different conceptual bases of measurement, which can be summarised in Table 1.
The multiple techniques presented above allows us to infer that the purpose of accounting is informational, i.e., arrangements with multiple measurement bases that provide Pareto optimal equilibria that endure for decades (or centuries) rather than ‘one size fits all’ types of measurement basis. As soon as the measurement is one of the necessary steps to achieve the main financial reporting goal, means have been developed, which must observe the essence of the item subject to measurement. That is, the fair value, as well as the historical cost, such as settlement values is nothing more than techniques of value attribution.

In this particular view of usefulness, a consolidated field was established, originally by Ball and Brown (1968), which seeks to evaluate the relevance of accounting numbers to the informational demands of the capital market. Lopes and Martins (2006) point out that the relevance of accounting information can be indicate by the ability to predict future cash flows, in an approach that is similar to that of Hendriksen and Van Breda (1999). This has been one of the motivating arguments for the concept of fair value to be progressively included in the two main global accounting systems, IFRS and US GAAP. Despite the relevance of the US accounting standard, we focus on IFRS-focused analysis, especially for the previously announced purposes of this commentary.

The inclusion of fair value in accounting system currently known as IFRS has been taking place gradually in the course of the 1990s. The moment of greatest impact of this expression was when IAS 39 was issued in 1998. Such a standard required that financial instruments, more specifically financial assets held for trading and available for sale, as well as derivatives, was measured at fair value subsequent to their initial recognition. It should be noted that there is a wide range of financial instruments that may be included in this set list, for example: stocks, swaps, futures, options, terms, fixed income investments, securities, among others.

4 Some examples of quantitative methods in fair value accounting

Following the arguments previously mentioned, we claim that fair value is a bridging element between financial accounting and quantitative methods, specially, for items that have to be marked-to-models. Hence, with the increase of this particular measurement concept it is expected that mathematical and statistical approaches be also more demanded by practitioners, auditors, standards setters and other groups directly or indirectly linked with financial accounting.

Table 2 contains a summary of balance-sheet items for which fair value is either require or allowed together with some examples of which quantitative techniques have been used to achieve fair value measurement in these circumstances.

It is important to mention that the term mark-to-model was employed in Table 2 as a reference for applications of fair value measurement to some extension of level 2 fair value measurements and to all level 3 fair value measurements, as defined in paragraphs 76, 81 and 86 of IFRS 1, of which we provide the following excerpts.

“Level 1 inputs are quoted prices (unadjusted) in active markets for identical assets or liabilities that the entity can access at the measurement date […].”

“Level 2 inputs are inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly […].”

“Level 3 inputs are unobservable inputs for the asset or liability.”
### Table 2  The interaction between financial accounting and quantitative methods

<table>
<thead>
<tr>
<th>Assets</th>
<th>Rules</th>
<th>Fair value</th>
<th>Mark-to-market</th>
<th>Mark-to-model</th>
<th>Quantitative techniques general applied to mark-to-model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current assets</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventories – commodities for trading</td>
<td>IAS 2</td>
<td>Allowed</td>
<td>Yes</td>
<td></td>
<td>DCF</td>
</tr>
<tr>
<td>Assets at fair value through profit or loss*</td>
<td>IAS 39</td>
<td>Required</td>
<td>Yes</td>
<td>Yes</td>
<td>DCF/regressions</td>
</tr>
<tr>
<td>Impairment test for financial instruments*</td>
<td>IFRS 9</td>
<td></td>
<td></td>
<td>Yes</td>
<td>Logit or probit regression</td>
</tr>
<tr>
<td><strong>Non-current assets</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property, plant and equipment</td>
<td>IAS 16</td>
<td>Allowed</td>
<td>Yes</td>
<td></td>
<td>DCF</td>
</tr>
<tr>
<td>Investment property</td>
<td>IAS 40</td>
<td>Allowed</td>
<td>Yes</td>
<td>Yes</td>
<td>DCF using income approach</td>
</tr>
<tr>
<td>Goodwill</td>
<td>IFRS 3</td>
<td>Required</td>
<td>Yes</td>
<td></td>
<td>DCF/valuation</td>
</tr>
<tr>
<td>Available-for-sale investments*</td>
<td>IAS 39</td>
<td>Required</td>
<td>Yes</td>
<td>Yes</td>
<td>DCF/regressions</td>
</tr>
<tr>
<td>Biological assets</td>
<td>IAS 41</td>
<td>Required</td>
<td></td>
<td>Yes</td>
<td>DCF</td>
</tr>
<tr>
<td><strong>Liabilities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Current liabilities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liabilities at fair value through profit or loss*</td>
<td>IAS 39</td>
<td>Allowed</td>
<td>Yes</td>
<td>Yes</td>
<td>DCF/regressions</td>
</tr>
<tr>
<td>Short-term provisions</td>
<td>IAS 37</td>
<td>Required</td>
<td></td>
<td>Yes</td>
<td>Probabilistic analysis</td>
</tr>
<tr>
<td><strong>Non-current liabilities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liability for share-based payments</td>
<td>IFRS 2</td>
<td>Required</td>
<td>Yes</td>
<td></td>
<td>DCF/regressions</td>
</tr>
<tr>
<td>Long-term provisions</td>
<td>IAS 37</td>
<td>Required</td>
<td>Yes</td>
<td></td>
<td>Probabilistic analysis</td>
</tr>
<tr>
<td><strong>Item that can be both assets or liabilities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Derivatives**</td>
<td>**</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td>Regressions/B and S for options</td>
</tr>
<tr>
<td>Hedge accounting**</td>
<td>**</td>
<td></td>
<td></td>
<td></td>
<td>Regressions</td>
</tr>
</tbody>
</table>

Notes: *IFRS 9 will be required from January of 2018. **Items treated in both documents IAS 39 and IFRS 9. DCF – discounted cash-flow. B&S – Black-Scholes.
Level 1 is the definition that is more closely related to the mark-to-market models; there is no need to adjust the observations because there is a total correlation between the balance-sheet items and marketed assets, consequently, the fair value shall be obtained through quoted prices. A common example in this context is the recognition of gains or losses arising from investments where the investor neither controls nor has significant influence and the fair value is required in order to capture the market variance of share-prices.

When level 1 is not applicable, level 2 fair value measurement rises as an alternative, some specific calibrations in the original conditions are necessary, such as quantity, geographic effects in logistical costs, products’ features, among other adjustments, to achieve a mark-to-market procedure that is comparable to the level 1 measurement. Some commodities and financial instruments are evaluated using this methodology. At this level, quantitative techniques become more relevant, because there is an increase in the accounting subjectivism that leads to larger discretionary accruals in comparison to level 1 measurement. Quantitative approaches can rise the reliability of the measurements because they act as a kind of exogenous method.

Eventually fair value measurement may only be possible at its level 3. In this category, there are no observable inputs in measuring the fair value of an asset or liability. It is the case of a number of biological assets and certain investment properties. This is particularly where quantitative methods become fundamental because in most occasions it will require the identification of proxy variables and the determination of probabilistic models to suit such variable in order to achieve reasonable and reliable fair value calculations. Consequently, in level 3 the discretionary accruals reach higher amounts and the use of quantitative tools provide a control of these outlooks, most appropriate because auditors and other gatekeepers can crosscheck companies’ expectations through the hypotheses used to operationalise the quantitative mechanisms that underlie the fair value estimate. The role of quantitative approach in this stage is not essential juts to provide a way to perform fair value, but it is also equally valid as a methodology that allow to be tested by exogenous players in the ‘supply chain’ of financial reports, which reduces potential criticism about the use of this measurement concept without economic fundaments. In other words, robust quantitative methods provide a scientific shield to measurements that by nature are subject to greater measurement error.

5 What is better after all?

Since the shift towards positive accounting theory aiming to explain and predict accounting practice and the emergence of decision-usefulness approach in setting accounting standards (as those issued by both IASB and FASB), the use of quantitative concepts and methods have been increasing in both accounting research and standard setting. However, little attention has been devoted to the use of quantitative methods in the accounting practice, which we claim to be also increasing, particularly in the application of IFRS around the world.

As set in stone by the IASB in its conceptual framework, the objective of general purpose financial reporting is to provide information about the reporting entity that is useful to investors, lenders and other creditors (either existing or potential) in making
decisions about providing resources to the entity. In other words, the IASB believes that financial statements should help users to better prospect future cash flows to the company that result from past events and transactions. Therefore, even though financial reports are tied to the past events and transactions, they shall inform users about their impact to the future cash flows to the company.

In this regard, it should not come as a surprise that, on the one hand, the IASB recognises the inaccuracy of the accounting process that gazes past events and transactions with its interest headed towards the future cash flows (it would be naïve to neglect such feature; future cannot be predicted accurately). Paragraph OB11 of The Conceptual Framework for Financial Reporting issued by the IASB is clear when it states that:

“To a large extent, financial reports are based on estimates, judgements and models rather than exact depictions. The conceptual framework establishes the concepts that underlie those estimates, judgements and models. The concepts are the goal towards which the Board and preparers of financial reports strive. As with most goals, the conceptual framework’s vision of ideal financial reporting is unlikely to be achieved in full, at least not in the short term, because it takes time to understand, accept and implement new ways of analysing transactions and other events. Nevertheless, establishing a goal towards which to strive is essential if financial reporting is to evolve so as to improve its usefulness.”

On the other hand, the IASB (2009) particularly emphasises the importance of estimates in the attempt to achieve its decision-usefulness objective. This view is present when discussing the reliability of measurement in the conceptual framework, paragraph 4.41:

“[…] In many cases, cost or value must be estimated; the use of reasonable estimates is an essential part of the preparation of financial statements and does not undermine their reliability […]”

It is then clear to the standard setter that, to be useful, financial reports must turn their gaze to the future. However, this usefulness decision which comes with a price: we can only estimate the future.

Consequently, we claim that quantitative methods are essential to the accounting practice in its best effort to depict the inherent uncertainty that comes along with the objective of capturing, measuring and disclosing future cash flow impacts resulting from past events and transactions. The increase of the value relevance of accounting numbers and other assertions is highly likely to be associated with the increase of the discretionary component of accruals. Considering that accruals are likely to carry informational content to the users of financial reports, the application of quantitative methods in the accounting practices is the actual possibility of mitigating the trade-off between usefulness and reliability, i.e., robust quantitative methods used in the preparation of financial reports offer the opportunity of providing information that is useful in predicting future cash flows and is also reliable.

References


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Notes

1 First issue in 1924.

2 Discretionary accruals are used here in a different context from earnings management studies.

3 Some of these examples will be detailed in the next sections.